MARCH 1953

# PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS
INVESTMENT CASTINGS
POWDER METALLURGY
PERMANENT MOLD CASTINGS
PLASTER MOLD CASTINGS

PMM

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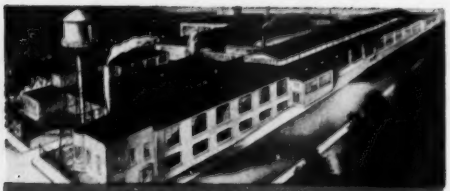

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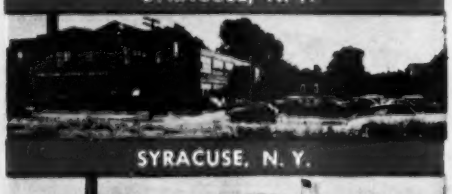

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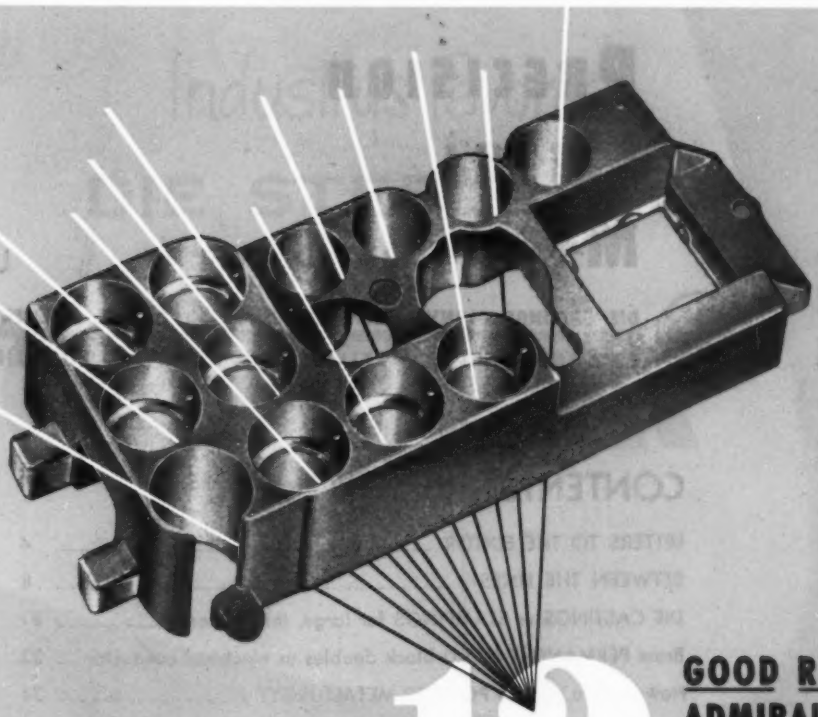

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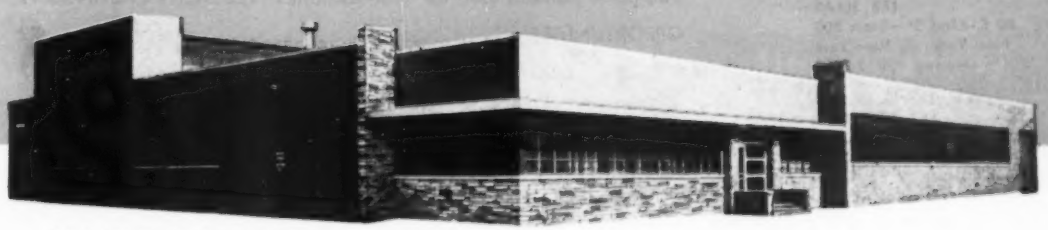
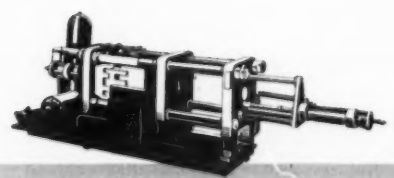


*Admiral Die Casting Corporation*
*200-256 West 83rd Street, Chicago 20, Illinois*

**Shown above is one tough job *multiplied by twelve.*** It is an integral part of a communications device, and each of those 12 thin-walled conduits calls for close tolerances, without machining or finishing. On jobs like this, profit depends on precision — and for precision, Admiral depends on Cast-Master. It's the same throughout the industry — *wherever you find the toughest jobs in die-casting, you find precision-built Cast-Masters.*



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MARCH 1953
Vol. 11 No. 3

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# PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • POWDER METALLURGY
PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

## CONTENTS

LETTERS TO THE EDITOR ---- 4
BETWEEN THE LINES ---- 8
DIE CASTINGS vs STAMPINGS for large, thin pieces ---- 31
Brass PERMANENT MOLD block doubles as electrical conductor ---- 33
How large a part by POWDER METALLURGY? ---- 34
INVESTMENT CAST housing accurately locates magnetic elements 36
DIE CASTING . . . answer for short run of a special shape ---- 38
Chromium-Nickel Alloy Steel SINTERINGS: an investigation of physical properties ---- 42
DIE CAST ZINC for stability and strength ---- 46
Two-piece patterns used for heat-resistant INVESTMENT CASTINGS 49
OPPORTUNITIES ---- 72
SIMPLIFIED SOLUTIONS for production problems ---- 77
INDUSTRY NEWS ---- 79
Pattern dies for INVESTMENT CASTINGS, Part 1 (A PMM Technical Report) ---- 82

## FINISHING SECTION

WET BLASTING as a method of surfacing die casting dies ---- 53
AIR-INFLATED CONTACT WHEELS extend range for abrasive belts 60
USEFUL LITERATURE ---- 62
REFERENCE MATERIAL ---- 64
NEW PRODUCTS ---- 67

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# LETTERS TO THE EDITOR

### POROUS BRONZE SHEET STOCK

In your January issue of Precision Metal Molding we note in an article by Mr. Charles Fillinger that porous bronze sheet stock is available to industry as a stock item.

We are not acquainted with any source for this material and therefore would appreciate the name and address of any reliable concern manufacturing this item.

In regard to your publication, we would like to extend our thanks to you for the copies which we receive and find that there are many excellent articles. — R. H. L.

*Information forwarded.—Ed.*

---

### VALUABLE FOR STUDENTS & ENGINEERS

I wish to thank you for the 20 copies of Precision Metal Molding for distribution among my students.

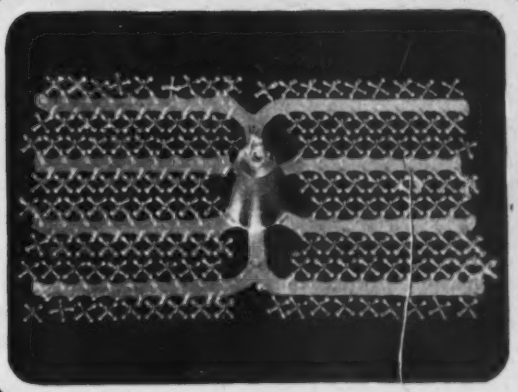
Review articles such as "Compacting Presses for Powder Metallurgy" are, in my opinion, extremely valuable not only for students but also for engineers interested in the field of powder metallurgy. A similar article concerning sintering furnaces would be highly desirable. — H. H.

*Work is underway to bring together an article on sintering furnaces, but the large amount of data that needs to be gathered and evaluated makes this a long-range project. We hope to have the article ready for publication by mid-year. — Ed.*

continued on page 6

*telling the story of 'dag' dispersions*

# Want to Eliminate Sticking in the Die? Try This!



Try a 'dag' colloidal graphite dispersion as a die lubricant. Here's why it's good.

It's more slippery than almost anything . . . wholly unaffected by heat up to 750°F. You can spray it on, paint it on, or apply it by dipping.

Dies so treated take on a *dry lubricating film* that eliminates sticking, improves finish, and reduces carbon build-up in die impressions.

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* * *

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... also ACHESON COLLOIDS LIMITED, LONDON, ENGLAND
Units of Acheson Industries, Inc.

*try resin-bonded dry graphite films for permanent lubrication*

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LETTERS TO THE EDITOR
continued from page 4

### PLASTER MOLD CASTING

I would like additional information on the plaster mold casting process, especially as to what types of plaster are used and how it is prepared, dried, etc. The articles in "Precision Metal Molding" are not clear on this point. — D. B. B.

*Source of reference on the materials and techniques has been passed along to reader. D. B. B. — Ed.*

---

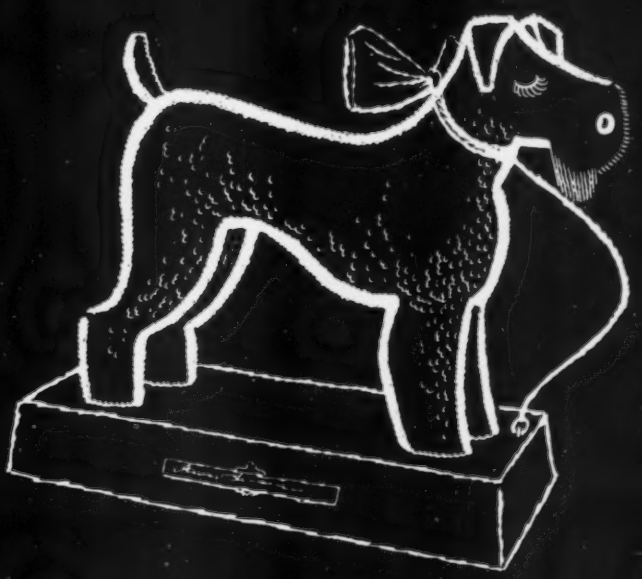
### HOBBED CAVITIES

I have read with considerable interest an article in one of your recent issues, on the production of Beryllium Copper moulds, and would be very much obliged if you can send me the full literature on this subject.

Whilst you are mailing to me, I should be obliged if you could possibly send me any literature and information which you may have or be able to get on the latest developments in hobbing techniques and steels for the production of moulds for plastics and pressure diecasting. — G. N. G. (England)

*All reference material we have on beryllium copper die cavities has been forwarded. Unfortunately, however, there is very little published material on hobbing techniques and steels. Such reference as is available has been noted. — Ed.*

# DIE CASTINGS *have Pedigrees too ...!*



The consistent uniformity of die castings by PRESSURE is not accidental. Like the strain of a purebred animal, such quality is constantly maintained by the meticulous care in the control of metallurgically correct alloys.

This, plus the utmost attention to the minutest detail, results in the faithful production of die castings of "pedigreed" quality—at PRESSURE.

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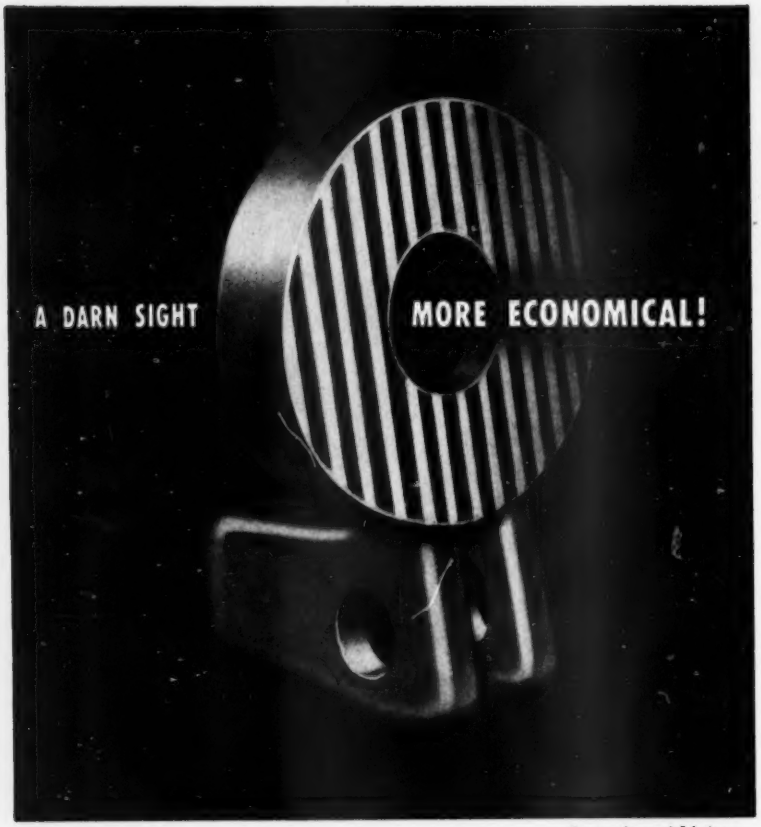


Part enlarged 14 times

## *An investment casting made of* BERYLCO BERYLLIUM COPPER

One of the smallest castings ever produced, this rifle peep sight of Berylco beryllium copper was formerly machined from extruded steel stock. Size made machining difficult, and it was impossible to consistently obtain the results desired from a steel investment casting. Berylco beryllium copper, on the other hand, reproduces minute detail (notice the serrations), permits sections as thin as 0.050", allows a tolerance of plus and minus 0.001" on the ⅛" distance between hole centers.

The low pouring temperature and the fluidity of Berylco make it easier to handle than steel. Its excellent castability gives you smoother surfaces, cleaner holes and slots, more readily filled thin sections.

In addition to offering design and production advantages which result in lower costs, Berylco compares favorably in strength and wear resistance with medium carbon and stainless steels, has greater corrosion resistance and electrical conductivity. These are some of the reasons why more and more designers are specifying Berylco for precision investment cast parts.

**The advantages of Berylco as an investment casting material are now being extensively advertised to designers. Take advantage of the trend. Send for your trial order today. Berylco is available in 5 lb., 2½ lb. and 3 oz. ingots.**

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## Between The Lines

### in this and coming issues of PMM

• BIG EVENT OF THE YEAR for the powder metallurgy industry is the annual meeting of the Metal Powder Association and the trade show held in conjunction with it. Cleveland is the city this year, and the dates are April 20-22. In marking this event, PMM will have some special features you will want to keep for your files pertaining to powder metallurgy.

• OUR 2ND ANNUAL DIRECTORY of the powder metallurgy industry will be a major feature in the April issue of PMM. It will have all companies listed who manufacture parts from metal powders, as well as manufacturers of equipment, powder and other supplies for this fast-growing industry. This is a reference piece to keep within reach all year long.

• WE HAVE RESULTS of a market research study that will merit the attention of every designer of iron parts weighing less than one pound. Several months of research activity have gone into this survey and the facts we have unearthed will be food for thought for every reader. This survey is also timed for presentation in April.

• OTHER MATERIAL especially prepared for our big April issue includes some special case history studies, a report on progress at several university research centers working in powder metallurgy, and complete coverage of the Metal Powder Show itself.

• ONE-BY-ONE we try to answer various questions we meet in the field, and in this issue, we have obtained some information in answer to the

continued on page 10

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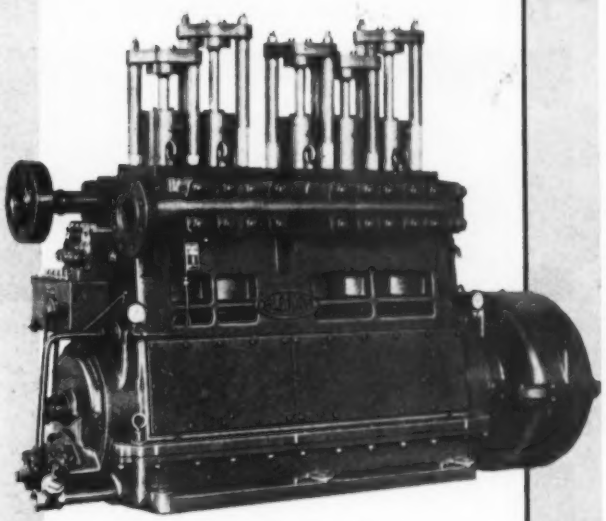
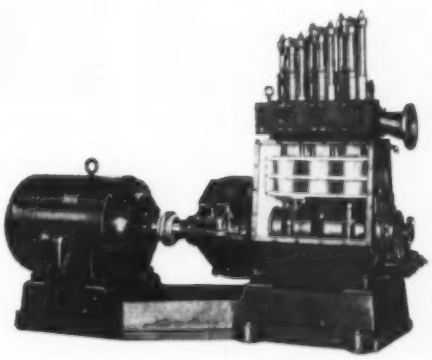


Aldrich Direct Flow 5" Stroke Quintuplex Pump. 150 hp.



Aldrich Direct Flow 5" Stroke Triplex Pump. 100 hp.

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# Check List

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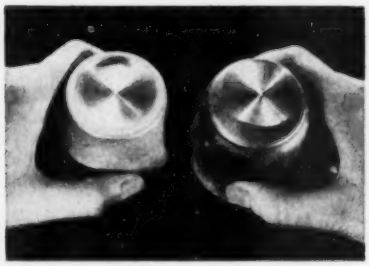
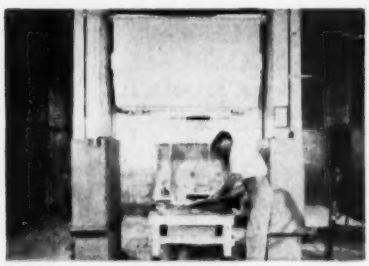
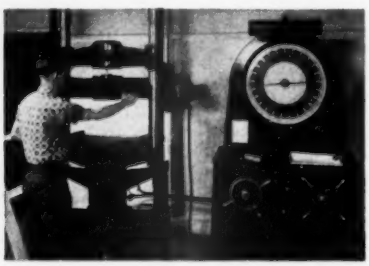


☑ **Freedom from Pinhole Porosity?**
Are sections of castings from each heat examined for pinhole porosity? That's the practice at Acme Aluminum Alloys where every heat must *prove* it has been properly degassed.

☑ **Close Dimensional Tolerances?**
Do your aluminum sand castings meet specifications for accuracy and freedom from external blemishes? Acme castings do . . . up to 1/64" accuracy on small sizes . . . up to 1/32" accuracy on large.



☑ **Freedom from Hidden Defects?**
Are you machining your aluminum castings as much as 75% complete only to discover hidden defects? Foundry practice at Acme uses X-ray to *prevent* defects, can be used for 100% X-ray.



☑ **Accurate Mechanical Properties?**
Are mechanical properties tested by test bar or a section from one of your castings? Using an actual casting produces more accurate results . . . is the method used by Acme.

A 6-point laboratory control system explains the outstanding quality of Acme aluminum castings. Moisture analysis of foundry sand . . . porosity analysis of each melt prior to pouring . . . analytical control by spectroscope . . . mechanical control by test castings . . . heat treat control to ± 5° F. by automatic equipment . . . hidden defects revealed by X-ray examination: this is the way Acme guards casting quality. *Are you getting top quality aluminum castings?*

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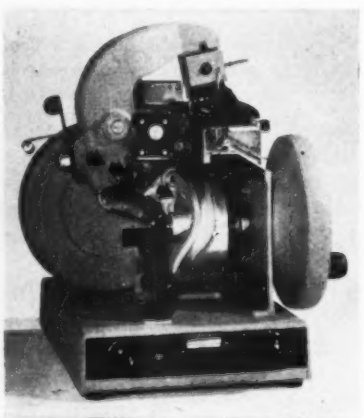
BETWEEN THE LINES
continued from page 8

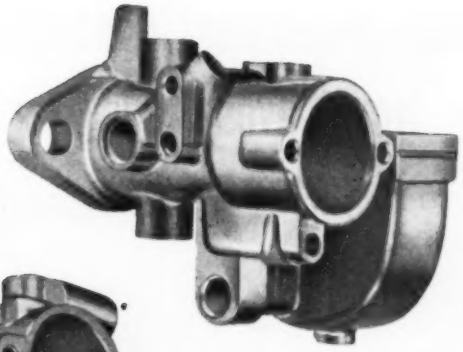
question, "How large can a sintering be?" We turned to an authority in the field of powder metallurgy for the answer begining on page 34.

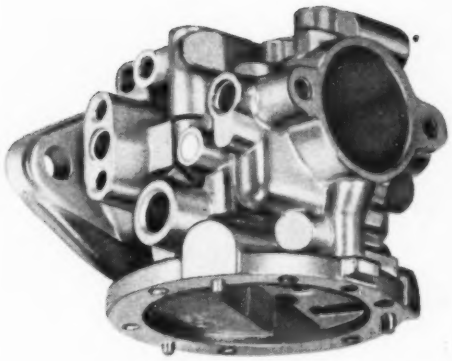
• HOW WOULD YOU MAKE IT? Here is a photograph showing a machine which requires an unusual cam. Arrows point to the cam which is the heart of the mechanism. It was a very interesting problem in machine design, and we are presenting the story of this cam beginning on page 38 of this issue.

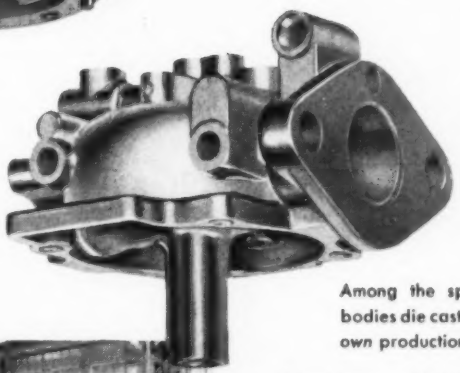


• YOU PROBABLY KNOW that investment castings are made from expendable patterns, but did you know that two or more patterns can be fastened together to produce a piece which has undercuts or interior detail of an unusual nature? A two-piece wax pattern has permitted great economy in manufacture of the infra-red burner described in an article on page 49.

• CLEANING UP DIES is one of the more prosaic aspects of making die castings, but it is one which needs careful attention. Comments on the use of wet abrasive blast equipment to prepare, recondition or clean the surfaces of die casting dies begins on page 55.







Tillotson Manufacturing Co. writes:

# "DIE CASTINGS BY HOOVER

## help us make a much better product at a much lower cost"

These complex die castings, produced by Hoover for the makers of the famous Tillotson Carburetors, are notable for their intricate coring and many close tolerances. They contain holes on all sides which must be perfectly aligned, and sections of the castings must be free from porosity to prevent leakage.

The Hoover Company's complete production facilities for promptly meeting your requirements include 8 zinc die-casting machines, and 27 aluminum die-casting machines carrying ratings up to 400 tons. Castings can be produced from the smallest practical size up to 12" x 12" area and 8 lbs. weight for aluminum and 7" x 10" and 5 lbs. for zinc.

Among the specific advantages of having their carburetor bodies die cast by Hoover . . . advantages that may apply to your own production problems . . . The Tillotson Company points out:

- **Broader possibilities in engineering design.**
- **Saving in machining time due to large percentage of small holes cored to size and flat surfaces cast smooth.**
- **Saving of number of machines in production line.**
- **Longer tool life, fewer tools required.**
- **Cleaner to handle, less scrap in plant.**
- **Almost complete elimination of rejects.**
- **Smoother, neater appearance and strength with lightweight which have increased our sales tremendously.**

THE HOOVER COMPANY, Die Casting Div., North Canton, Ohio

*Get a bid from*

# HOOVER

*Specialists in the fields of die castings since 1922*

Write for file folder, "Die Castings." Shows how to step up production and cut costs. Shows their advantages, how they are made, how they should be designed, how they help you step up production and cut costs.

*For additional information Circle No. 10 on the Reader Service Card*

# Which of These Precision Investment Castings Now Saves Money for Your Industry?

**Industrial Heating** – This atomizer nozzle for oil furnaces used to require machining in five parts. By precision casting it can be made in three. "S"® Monel is used for corrosion and wear resistance and resistance to steam erosion.

**Power Equipment** – If these carbon steel parts for the trigger mechanism on power tools were machined, a year's supply would have to be made. Parts are now made by precision casting in monthly quantities and at a saving.

**Aeronautical** – Power recovery buckets are precision cast of cobalt alloy to promote strength and resistance to exhaust gases. This alloy has a Rockwell C hardness of 27 and would be extremely costly to fabricate.

**Food Processing** – This collet spreader for a liquor dispenser is precision cast of Inconel® to prevent metallic pick-up from causing discoloration of the liquor. If made by machining methods the cost would be much higher.

**Gun Manufacturing** – This cartridge stop for a shot gun is made of tool steel for wear resistance. Precision casting was used to save the high cost of machining.

**Chemical** – Here's a precision cast valve stem for railroad tank cars. It was cast in Monel® to resist corrosion by chlorine. Previous fabricating methods cost nearly twice as much.

**Instrument Manufacturing**—This gyroscope gimbal is precision cast in carbon steel to insure strength. It would be impractical to die cast this hard metal.

**Electrical**—Here's a carbon jaw for a motion picture projector. It's made of nickel to resist spark erosion and give long service life. Saving of scrap metal by precision casting makes possible the use of this higher alloy at little additional cost.

**Surgical Equipment** – Another example of how precision castings save high machining costs in this stainless steel lug for stomach suturing apparatus.

**Sporting Goods** – This little gadget would be prohibitively priced if made by conventional methods. It's a pick-up finger for a fishing reel and is precision cast of "H"® Monel to resist corrosion by sea water and air.

**SOME ALLOYS PRECISION CAST BY INCO**

Nickel-Base Alloys
Ferrous Alloys
Austenitic Stainless Steels
Martensitic Stainless Steels
Ferritic Stainless Steels
Carbon Steels
Alloy Steels
Cobalt-Base Alloys

These examples show a few of the many places precision investment castings are used.

They can save as much as 50 percent of production cost. They reduce machine shop bottle-necks, make possible use of extremely hard metals, permit production of designs impossible to fabricate by other methods and frequently lend to economies through re-design. Since they reduce metal scrap, they often permit the use of a higher alloy which otherwise would be too costly.

Whenever you have a part which is 6" x 5" or smaller, weighs under 3 lbs., requires tolerances as close as plus or minus .005" per linear inch, and would need 5 or more fabrication steps, there is a good chance you can cut costs by having it precision cast.

For more information, write for your free copy of "Investment Casting—Its Advantages and Practical Applications." The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

**Inco Castings** INCO TRADE MARK **PRECISION, SAND, CENTRIFUGAL**

*For additional information Circle No. 13 on the Reader Service Card*

# Do you use parts like any of these*?

***All made as DOLLIN Zinc and Aluminum Die-Castings**

Most of these parts were purchased by leading manufacturers . . . experts at getting the "best buy". Do you see one that resembles a part you use now, or need? If you do, why not check with us for possible savings? Send prints or samples for estimates and engineering advice, at no obligation. Or, write for our General Facilities and/or Small Parts Bulletins.

**DOLLIN CORPORATION, 614 South 21st Street, Irvington, N. J.**

**DOLLIN Zinc and Aluminum DIE-CASTINGS**

Sales Offices: Boston • Buffalo • Canton • Chicago Detroit • Philadelphia • Pittsburgh • St. Louis • St. Paul

*For additional information Circle No. 9 on the Reader Service Card*

**CLOSER TEMPERATURE CONTROL, CLEANER ALUMINUM, COOLER AND LESS CONGESTED CONDITIONS ARE OBTAINED WITH**

# AJAX TAMA-WYATT *Induction Furnaces*–

Thousands of die cast rotors for hermetic motors are made from pure aluminum poured from a battery of AJAX Electric Induction Furnaces installed in the St. Louis plant of the Emerson Electric Mfg. Co. Two of these furnaces are shown in the photograph at right.

Close-up of die-cast aluminum rotor which is pressed onto the compressor shaft extension used in refrigeration units.

Our electrical industry produces fractional horse power motors at the rate of 20 to 25 millions per year. After World War II the leading manufacturers changed from fabricated copper rotors to cast aluminum rotors. In this operation, aluminum of high purity under closely controlled temperature is required.

In many cases the machines had to be placed right on the assembly line, with severe space restrictions and, of course, with rigid requirements for reliability. AJAX induction furnaces and AJAX automatic pouring units were selected for this job in almost all the plants which switched from copper to aluminum rotors.

***Write for further information to***

**AJAX ENGINEERING CORP., TRENTON 7, N. J.**

AJAX TAMA-WYATT INDUCTION MELTING FURNACE

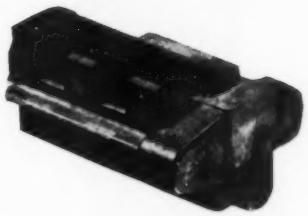
**AJAX ELECTRO METALLURGICAL CORP.**, and Associated Companies
**AJAX ELECTROTHERMIC CORP.**, Ajax Northrup High Frequency Induction Furnaces
**AJAX ELECTRIC CO., INC.**, The Ajax Hultgren Electric Salt Bath Furnace
**AJAX ELECTRIC FURNACE CORP.**, Ajax Wyatt Induction Furnaces for Melting

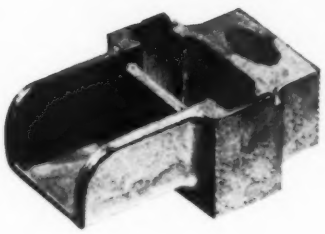
*For additional information Circle No. 2 on the Reader Service Card*

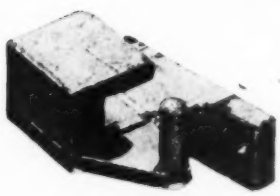
# Take Your Pick

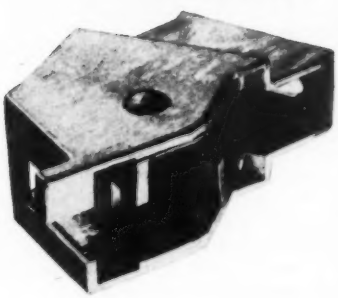
## PRESSCO Pressure Die Castings, Gravity Die Castings, and Centrifugal Castings* Are Now Available In a Wide Range of Brass and Bronze Alloys.

Whatever your casting requirements, maybe Pressco has a "ready-made" alloy to fill your requirements. Castings can be supplied completely machined if required.









BRUSH HOLDERS are a specialty with Pressco. We can help you pick the right alloy and right process for your brush holders. Shown above are a few of the many standard and special brush holders we have produced successfully. In most cases they are machined to very close tolerances in our captive machine shop.

**Properties of copper-base alloys currently cast by PRESSCO**

| Alloy | Casting† Method | Similar Alloy | Tensile Strength P.S.I. | Yield Strength 5% offset P.S.I. | Elongation % in 2" | Hardness Rockwell B | Electrical Conductivity % of OFHC copper |
|---|---|---|---|---|---|---|---|
| Pressco No. 1 Aluminum bronze* | C, G | ASTM B 148-49, 9B SAE 68 Grade B | 80,000 | 36,000 | 17-26 | 75-85 | 12 |
| Pressco No. 2 Silicon bronze | D | ASTM B 176-50 Alloy C | 85,000 | 40,000 | 6-8 | 75-90 | 12 |
| Pressco No. 3 Manganese bronze | G | ASTM B 147-49, Alloy 8A SAE 43 | 76,000 | 33,000 | 15 | 60-70 | |
| Pressco No. 4 Yellow brass | D | ASTM B 176-50 Alloy A | 60,000 | 35,000 | 12 | 60-70 | 26 |
| Pressco No. 5 Ni. Alum. bronze*** | G | ASTM B 148-49 Alloy 9D | 90,000 | 40,000 | 10 | 85-95 | |
| Pressco No. 6 Yellow brass** | G | ASTM B 124-49 Alloy 1 | 40,000 | 11,000 | 25 | 40-50 | 28 |
| Pressco No. 7 Alcop 3 | C | | 63,000 | 35,000 | 30 | 60-70 | 24 |
| Pressco No. 8 Nickel aluminum bronze | G | | 115,000 | 82,000 | 3 | 105 | |
| Pressco No. 9 Leaded brass | G | ASTM B 146-49 Alloy 6B SAE 41 | 49,000 | 12,000 | 15 | 30-35 | |
| Pressco No. 10 Silicon brass**** | G | | 74,000 | 38,000 | 19 | 78-82 | |

* Can be heat treated to raise physical properties.
** Lead generally omitted in gravity die castings.
*** Alloy not applicable to all casting designs.
**** Special high strength, free machining alloy developed for gravity die casting
†Casting Methods: C - Centrifugal; D - Pressure; G - Gravity.

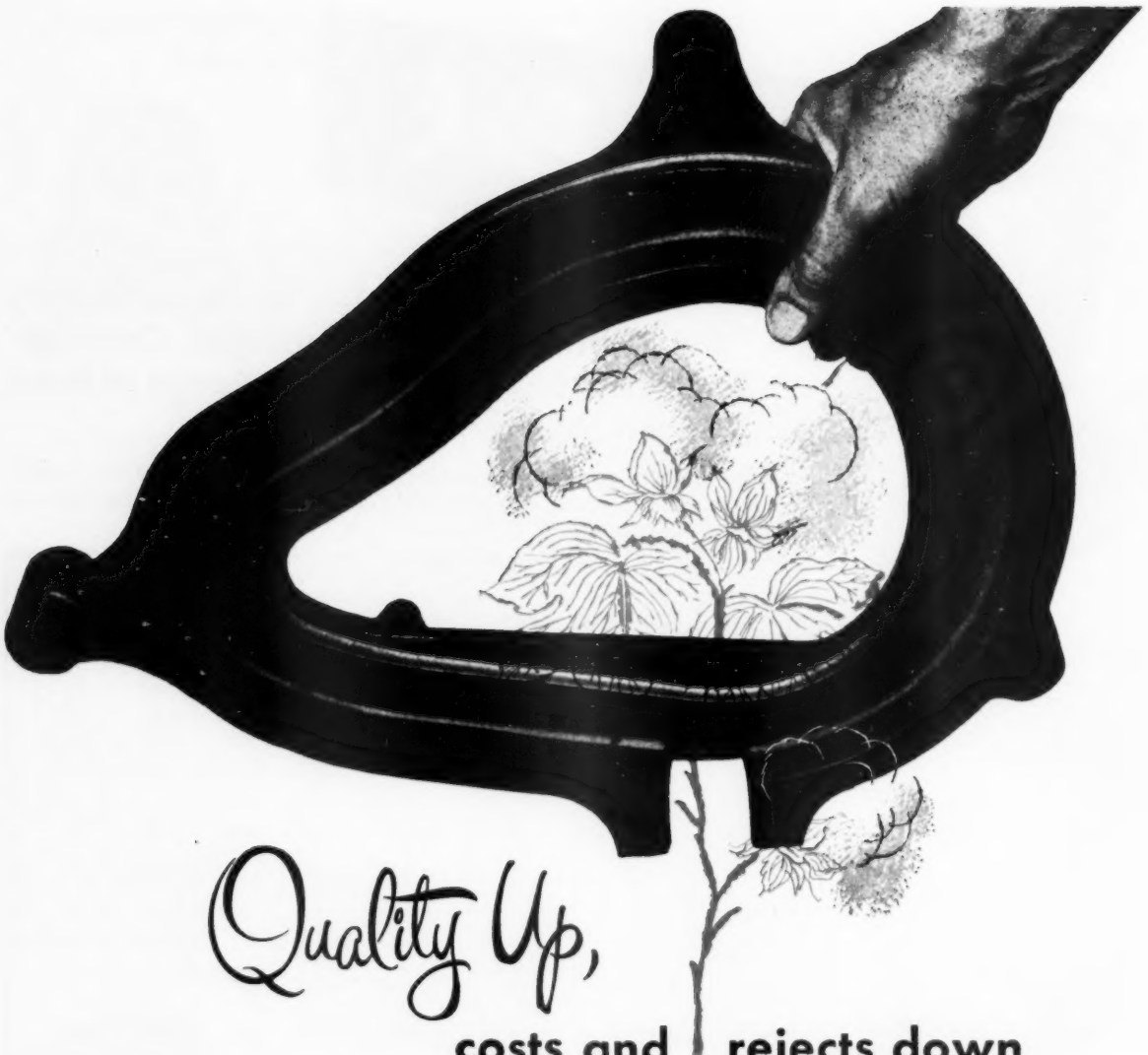
**Largest exclusive manufacturers of brass and bronze pressure die castings, gravity die castings and centrifugal castings.**

*Write today for booklet fully describing design limits, tolerances and physical properties of Pressco castings.*

Chesterton 9224

**PRESSCO CASTING & MFG. CORP.**
Chesterton, Indiana

*For additional information Circle No. 23 on the Reader Service Card*



# Quality Up,

## costs and rejects down
## WITH CRUCIBLE TOOL STEEL CASTINGS

The steel part shown above used to be a production headache. A cam for a cotton picking machine, it was originally flame cut from SAE 8730 boiler plate, machined and heat treated. Other difficult steps included end-milling and finish-grinding the cam track. Rejections were high, because the cam often warped during heat treatment.

The problem was solved by casting the cam in Airkool®, a Crucible air-hardening tool steel. When the customer receives the casting from Crucible, all he has to do is finish it, mill the cam track and heat treat. He doesn't have to finish grind — Airkool is non-deforming when properly hardened and tempered. Machining costs are way down and quality is up, since Airkool resists wear far better than the low alloy steel from which the part used to be made.

Crucible's casting facilities often make it possible to use wear- and abrasion-resisting tool steel for complicated machine parts. We may be able to help you just as we helped the cotton picking machine manufacturer. Get in touch with Crucible today!

**CRUCIBLE**

53 years of Fine steelmaking

first name in special purpose steels

**SAND CASTINGS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

*For additional information Circle No. 7 on the Reader Service Card*

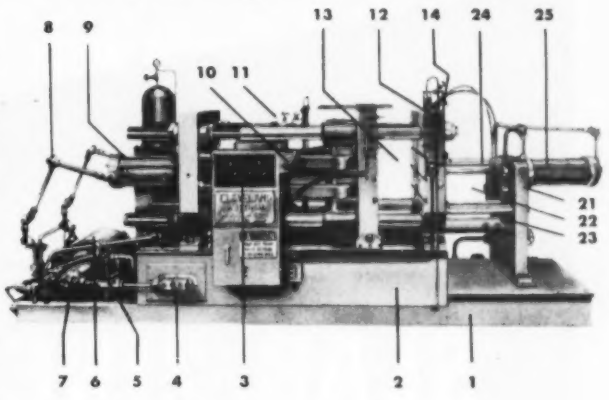
# Why you can count on CLEVELANDS

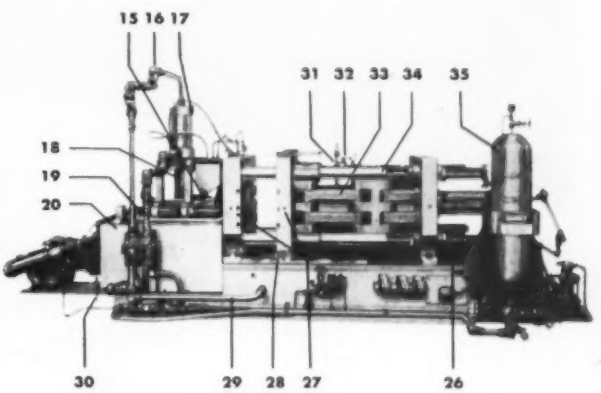
## to give you precision quality die castings at a highly profitable rate of production

**35 POINTS OF DESIGN AND CONSTRUCTION SUPERIORITY** have made Cleveland Die Casting Machines the leader in this field. Many of these features are exclusive with Clevelands . . . others were pioneered by Cleveland and are now in general use throughout the industry. *All* add up to give Clevelands the qualities so essential for successful die casting:

- Rugged, rigid construction throughout for dependable, economical performance
- Powerful die locking pressure
- Fast, shockless die closing and opening for high production operation
- High metal injection speed to produce sound, dense, "hardware finish" castings
- Safe and simple control—manual or automatic
- Ample elbow room for die mounting and machine maintenance
- Universal construction — easily convertible — for either hot or cold chamber operation

These are the reasons why Clevelands are selected by many of the nation's most experienced die casters . . . why *two* of the country's foremost die casting producers have installed 32 Clevelands each . . . and a *third* has installed 33! And why Clevelands can be found in 'round-the-clock production in 12 foreign nations as well. Let a Cleveland Engineer show you how Cleveland Machines can improve your production with money saved!




Photographs above, with 35 points of Cleveland superiority indicated, show front view of the widely-used Cleveland Model 400 with aluminum shot end, and rear view of the Model 400 with zinc shot end. Cleveland Model 400 has 36" x 38" die plates; 400 tons locking pressure. Other Cleveland machines include the Model 200, 30" x 31" die plates; Model 100, 22½" x 24½" die plates; Model 50, 18" x 22" die plates.

**MAKE A POINT-BY-POINT COMPARISON OF CONSTRUCTION FEATURES . . . THEN YOU'LL CHOOSE Clevelands!**

**Bulletin 400 gives you complete details. Write for your free copy.**

**QUICK DELIVERIES NOW POSSIBLE ON MOST MODELS**

**THE CLEVELAND AUTOMATIC MACHINE COMPANY**

**4952 Beech Street**
**Cincinnati 12, Ohio**

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

**Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines**

*For additional information Circle No. 6 on the Reader Service Card*

for Quality Production

AMERICAN ELECTROLYTIC

# 99.99+% SLAB ZINC

A reliable source for die casting requirements

**AMERICAN ZINC SALES COMPANY**

Distributors for

**American Zinc, Lead & Smelting Company**

Columbus, Ohio • Chicago • St. Louis • New York

*For additional information Circle No. 4 on the Reader Service Card*

PRECISION FROM

# KIOWA

PRINT TO PRODUCT

YOUR *Market Place*

FOR NON-FERROUS CASTINGS

A DEPENDABLE AND ECONOMICAL SOURCE OF SUPPLY FOR LEADING MIDWEST MANUFACTURERS!

Bell & Gossett Co.
Bettendorf Oil Burner Co.
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- **Aluminum and Zinc Base Die Castings**
- **Brass, Bronze, Aluminum Sand Castings**
- **Aluminum Gravity Die Castings**

*When YOU Think of Castings . . . Think of KIOWA*

OVER A QUARTER CENTURY IN CASTINGS

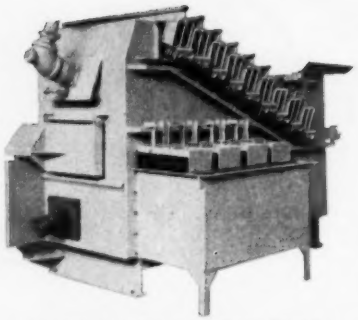
## KIOWA CORPORATION

MARSHALLTOWN, IOWA

*For additional information Circle No. 14 on the Reader Service Card*

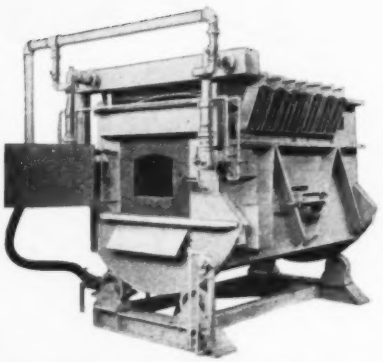
# ALUMINUM

**These Stroman Built Furnaces are designed for production of unsurpassed quality metal in the fastest, most efficient and economical manner. Built for all purposes and capacities they meet the demands of the sand foundries, die casters, permanent mold plants and smelters. They are recognized as the finest in the industry and reduce costs and make working conditions most agreeable. All furnaces may be fired by oil or gas.**



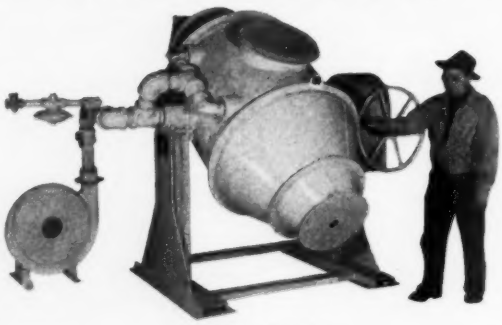
### MODEL "MC" DIP-OUT TYPE

For melting and holding all in the same furnace. Hot metal always available. No iron pots or crucibles to replace. Capacities from 500 to 5000 pounds aluminum.



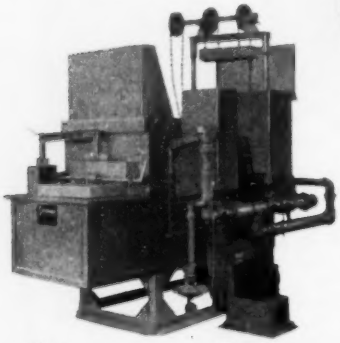
### MODEL "SW"—TILTING TYPE

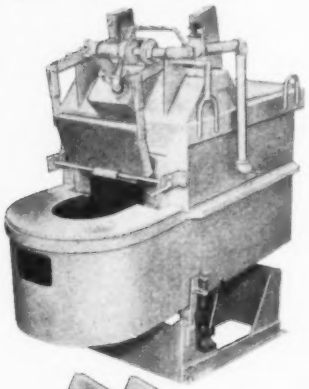
Excellent to run back returns along with ingot required for permanent mold, die or sand casting operations. Also an ideal breakdown furnace. Capacities—600-1000-1700-3000 lbs. Aluminum.

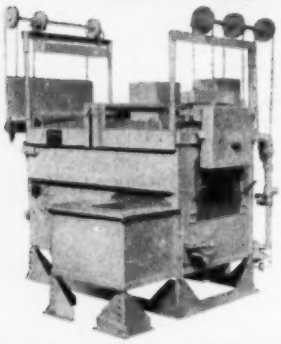


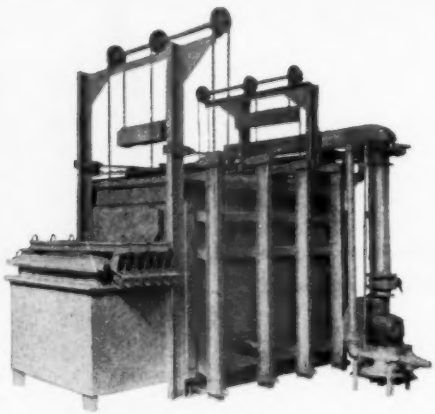
### MODEL "BFC"

Hand tilt, open flame, barrel type furnace with flames firing tangent to inside of lining. Very fast melting. Used in all type plants including smelters. Capacities—500 lbs. Aluminum. A must for all aluminum jobbing sand foundries.



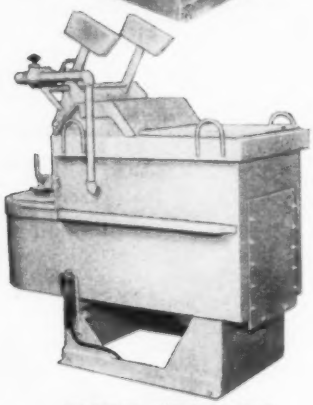






### SMELTERS FURNACE

Built especially for smelters and other large melters. Easy charging, drossing, fluxing and alloying. Can be built to your own specifications. Capacities from 3000 lbs. Aluminum up.



### MODEL "DSC" DIE CASTING FURNACE

A small reverberatory furnace for melting and holding, or for holding only when hot charged at the die casting machine. Made in various sizes to meet your requirements.

### MODEL "DC" FURNACE

The 2 in 1 furnace. Breakdown and Holding in the same unit. Cold metal never reaches the molten bath. Assures metal of the finest quality on all classes of work. Close temperature control. Can be used as a sweat furnace for reclaiming inserts. Ideal for all types of plants including sand, permanent mold and die casting. Capacities from 350 lbs. Aluminum up.

**STROMAN ALSO BUILDS FURNACES FOR THE MELTING OF BRASS, BRONZE, MAGNESIUM, IRON, ETC., ALSO CORE OVENS. WRITE TODAY FOR NEW CATALOGUE NO. 800.**

## STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

# put 43 years of experience to work for you...

## DIE CASTINGS BY STEWART

**Services Available**

**Designing • Engineering**

**Die Making • Metallurgical Control**

**Most Modern Die Casting Equipment**

**Complete Machining, Polishing and Assembly Facilities**

*small . . . large*

*. . . simple . . . intricate*

**In zinc, aluminum or magnesium**

Stewart DIE CASTING

A DIVISION OF... STEWART SW WARNER

CHICAGO, ILL., 4535 FULLERTON AVE. . . . BRIDGEPORT, CONN., 275 WARREN ST.

**Complicated Castings?**

# H-P-M "400" Die Casters Produce them for *Mall* Tools!

Mall Tool Company reports—"Our three H-P-M Die Casters work 17 hours a day, 5½ days a week and are giving excellent service".

Mall's famous line of portable tools calls for a wide range of die castings . . . many of them complicated castings of intricate design . . . all produced on H-P-M's.

H-P-M's new Model 400-B high speed die casting machine, with built-in nitrogen accumulator, offers injection speeds up to 400 ft. per minute and produces aluminum castings weighing up to 12.2 lbs. Other design features include all-hydraulic die clamp for fast, simple die change-over . . . hydraulic ejectors . . . dual hydro-electric safety devices . . . maximum injection pressure when die is filled . . . and independent handwheel adjustment for both die clamp and injection pressures.

Discuss your die casting problems with an H-P-M engineer and profit from 75 years of specialized experience in the field of hydraulics.

**SPECIFICATIONS MODEL 400-B**

| Size of Die Plates | Space Between Bars | Die Opens | Maximum Die Space | Capacity Per Shot (Lbs.) | Net Wt. (Lbs.) |
|---|---|---|---|---|---|
| 38"x38" | 23"x23" | 16" | 42" | 2.2 to 12.2 (Al)* | 40,000 |

**NOTE: The model 400-B handles brass and magnesium die casting as well. Complete specifications on request.*

*Write for Catalog 5106, today!*

**THE HYDRAULIC PRESS MFG. COMPANY**

1094 MARION ROAD

MOUNT GILEAD, OHIO, U. S. A.

Builders of Presses for the Metal Working & Processing Industries • Plastics Molding Presses • Die Casting Machines • Hydraulic Pumps, Valves & Power Units

*For additional information Circle No. 12 on the Reader Service Card*

# BETTS MACHINE COMPANY

*lights the way to lower costs with—*

# PARKER DIE CASTINGS

BETTS MACHINE COMPANY, Warren, Pa., is using Parker Die Castings for the *housing* and *hex nut socket* on their Truck Clearance Lights. These lights are pressure tight and "bubble-proof" thanks to Parker's ability to provide leak proof and non-porous die castings. Die castings were also selected because they eliminate machining—to lower production costs. For more than fifty years Parker die castings have been specified by manufacturers in industry . . . automotive, aviation, electrical, business machines and many others. The experience thus gained by Parker can be used to your benefit. Consult with Parker engineers on your next die casting requirements.

*and when you think of Die Castings* THINK OF

**Parker White-Metal Company • 2153 McKinley Ave., Erie, Pa.**

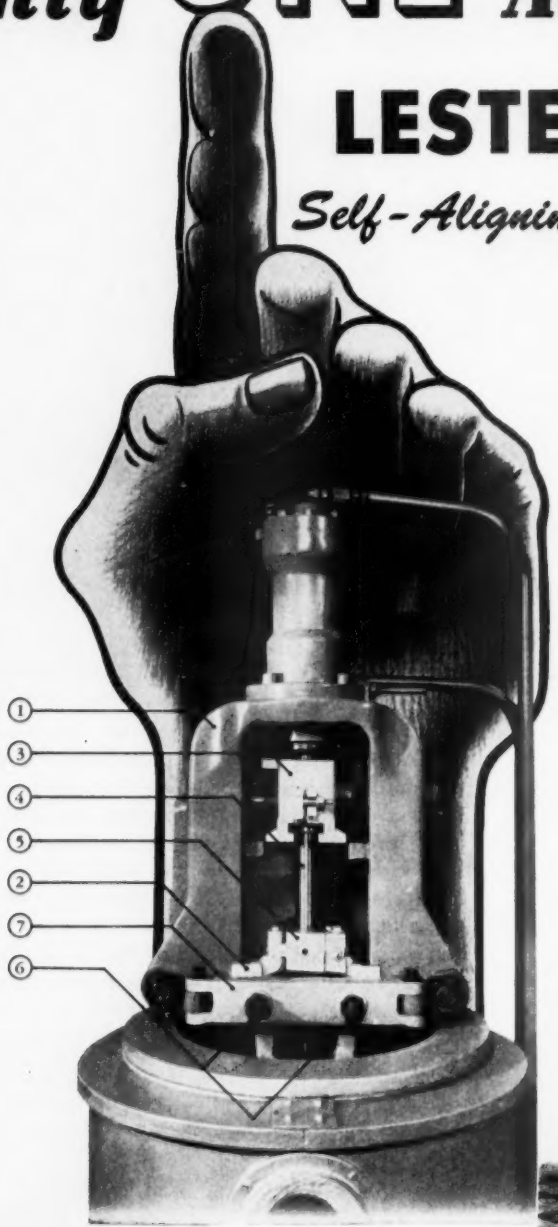
# PARKER ALUMINUM *and* ZINC *Die Castings*

# Only ONE Adjustment

## LESTER-PHOENIX

## *Self-Aligning* ZINC END

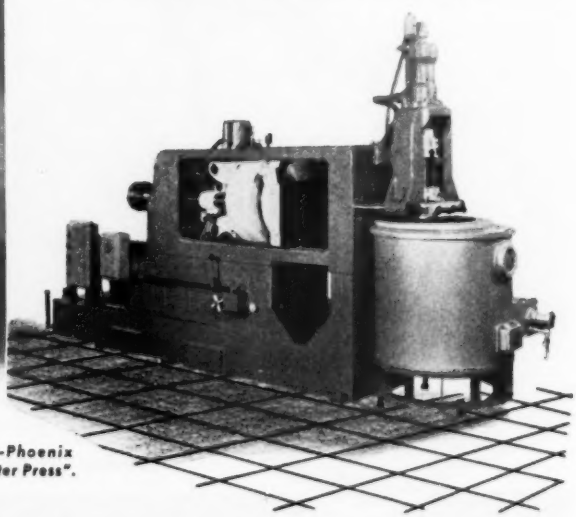
### *Simplifies machine set-up*




The injection system on all Lester-Phoenix zinc die casting machines is sturdy and simple: The entire shot system is located in machined slots in the one-piece yoke (1). The one-piece cast iron gooseneck (2) with nitralloy sleeve, cannot be misaligned. A split plunger cylinder coupling (3) holds the plunger stem (4) which is guided by the split bronze bushing (5).

The only adjustment required is turning the two adjusting screws (6) in the lock bracket (7) to set the nozzle firmly in the sprue bushing. The plunger tip is heat treated steel protected with piston rings. And, since the injection oil cylinder is stationary, all pressure pipe lines are rigid, extra-heavy steel pipe for safety.

Write for full specifications on the machine whose capacity will meet your requirements.



*Write for the Lester-Phoenix house organ, "The Lester Press".*

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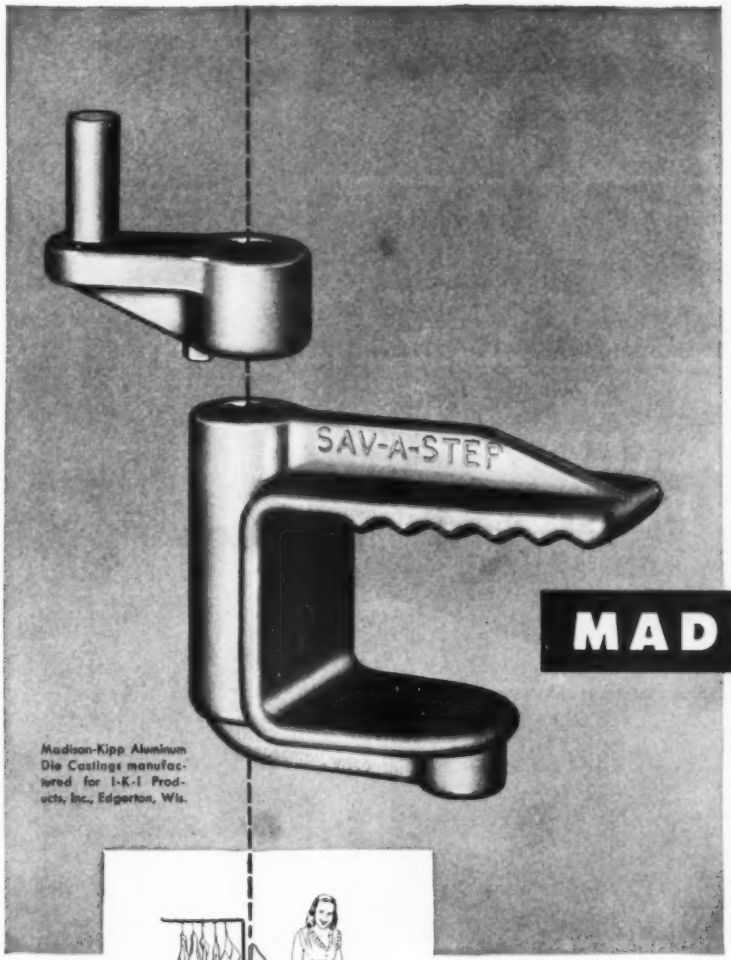


Madison-Kipp Aluminum Die Castings manufactured for I-K-I Products, Inc., Edgerton, Wis.

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1 DIE CASTING is the Process...

2 ZINC, the Metal...

number 3 of a series

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In view of its present rank as a consumer of zinc, it is interesting to note that up until 1925, the American Bureau of Metal Statistics and the U.S. Bureau of Mines reported the tonnages of zinc used in die casting alloys under the heading of "other uses." In 1926, the first year that the industry was accorded the distinction of a separate classification as a zinc consuming industry, only 4% of all the zinc consumed in the United States was used in die casting alloys. This was due to the fact that die castings, based on the grades of zinc then available, were restricted in their applications on account of limitations in physical properties. With the advent of Bunker Hill 99.99+% Zinc, and with practically no change in the existing alloys but the substitution of "four-nines" for "three-nines" zinc as a base, the use of zinc alloy castings increased enormously. Currently, the die casting industry accounts for about 30% of the country's total annual zinc consumption.

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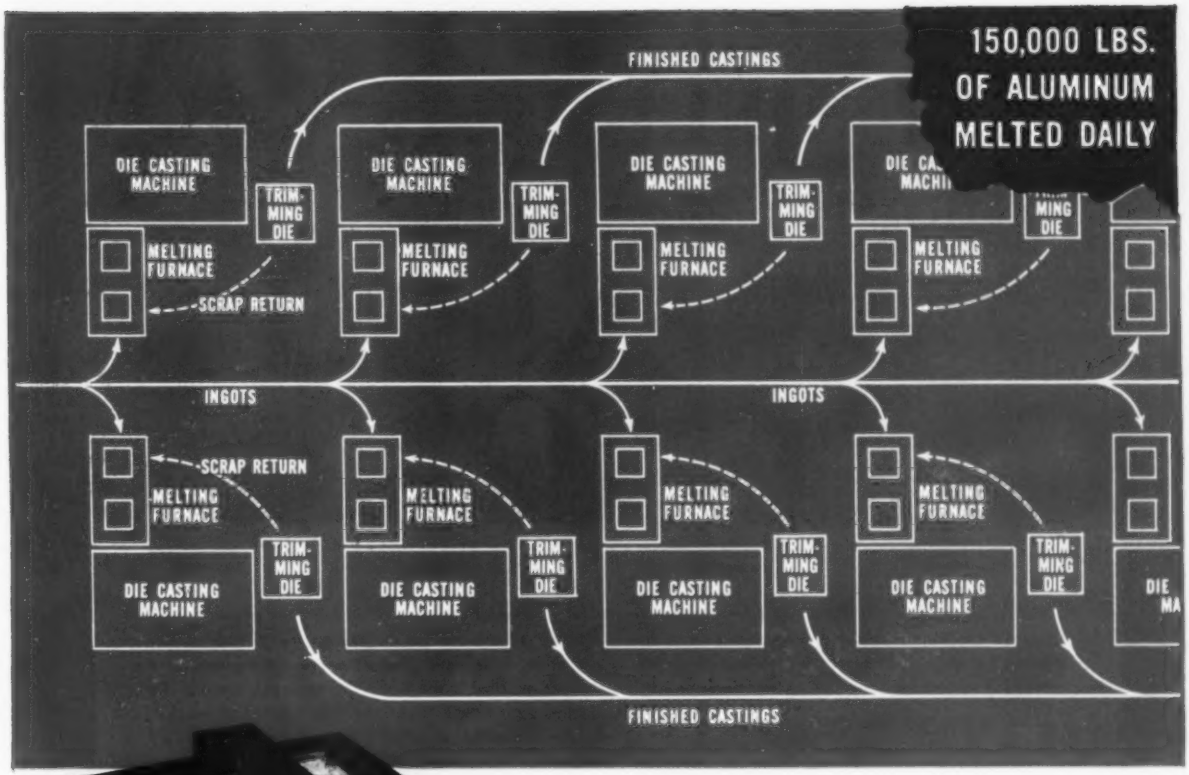

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**No melting room needed**—all metal is melted at the casting machine, eliminating the need for carrying hot metal through the plant.

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**Unified production unit**—each die casting machine becomes a unified production unit—receiving cold alloy ingot, melting, holding, casting, inspecting, reclaiming scrap metal and reject castings—delivering only the finished casting to the production line. Obviously the savings realized are spectacular.

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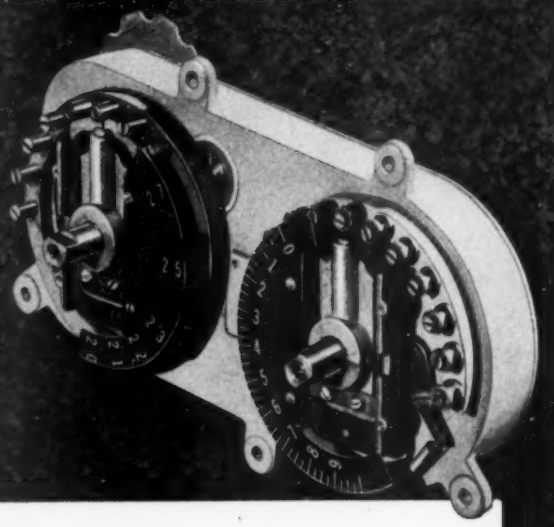

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Take, for example, the Lewyt Corporation. Even as vacuum cleaners march steadily along its production lines, a division of the plant is being devoted to manufacture of components for military radio transmitter-receiver sets.

Shown here, is a Lewyt-made, panel-mounted dial drive assembly. The gear train housing, produced by Mount Vernon, is cast in two matching halves, *complete with bushings and all details as specified.* With a minimum of machining, a tight fit of the two portions is obtained, and the housing is ready to receive the intricate gear assembly needed for coupling the megacycle and one-tenth megacycle controls, and other parts, to each other.

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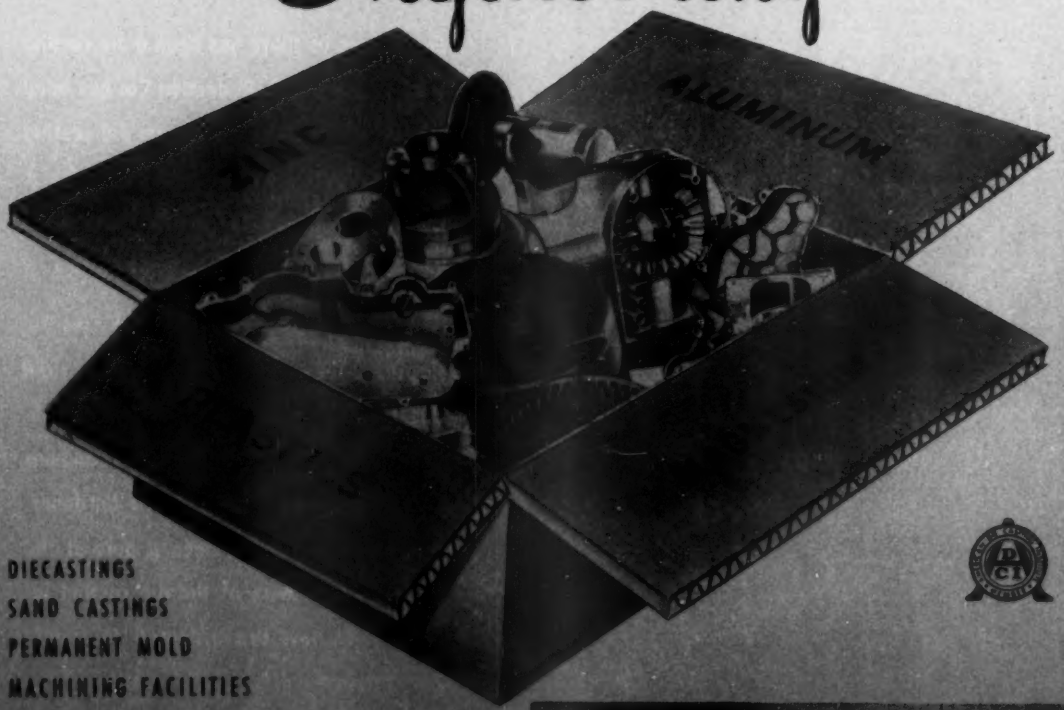


- DIECASTINGS
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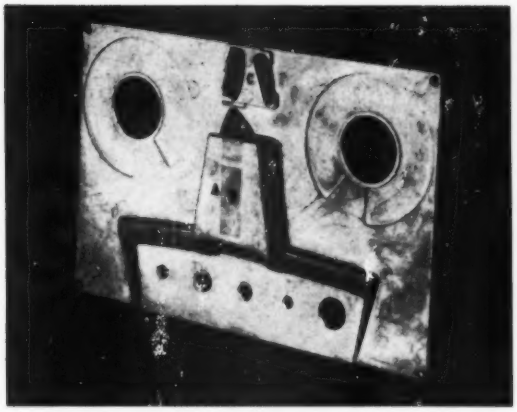
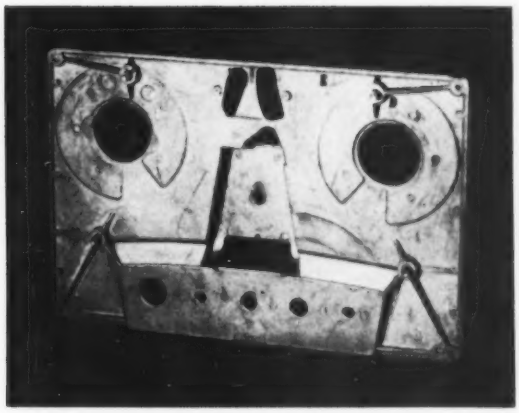


**1. INCREASED RIGIDITY is gained by including raised portions A, B and C as integral parts of the die casting left, rather than as separate pieces as would be characteristic of a stamped panel.**



**2. RAPID WRITE-OFF of die costs is made possible by large savings on assembly and other secondary operations. Note the disposition of stiffeners on and around the underside.**

# DIE CASTINGS vs STAMPINGS for large, thin pieces

ONE of the problems in connection with the production of portable electronic equipment is the proper housing and protection of the relatively delicate components. Some of the peculiar shapes and uses of these components make the housing requirements difficult. In addition, the fact that the equipment is portable requires that the weight be kept as low as possible and obviously cost should be kept down. The Ekotape recorder made by the Webster Electric Co. of Racine, Wisc., is just such a piece of equipment.

In order to achieve the most desirable combination of weight, shape and protection, several of the housing components are made as aluminum die castings by the Madison-Kipp Co. of Madison, Wisc.

The top panel shown in obverse Figure 1 and reverse Figure 2, is very thin-walled, particularly for an aluminum die casting. The great variation in level, necessitated by the shape and position of the electronic and drive components further increases the difficulty of casting this part.

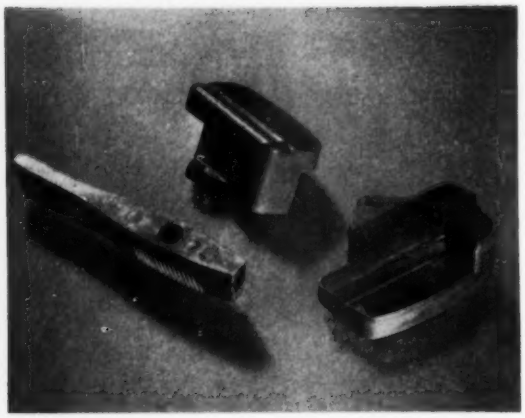
At first glance, it would seem that a steel stamping would be a more suitable panel. If such a stamping were used, the cover (A) for the drive controls and the mechanism operating cam would have to be a separate piece, necessitating a fastening method of some sort and an extra operation to install it. Further, in a steel stamping, a hole the size needed, would seriously weaken the panel and no stiffening members could be incorporated.

As a die casting, this panel can have the cover, noted above, cast integrally with the balance of the cover panel. This not only reduces the cost of assembly, but acts as an effective stiffening member in the center of the panel.

The raised flange (B) around that part of the panel where the control knobs are located improves the appearances of the panel, helps to protect the knobs from damage and increases the rigidity of the entire panel without increasing weight appreciably. As a stamping, this flange could not be incorporated as an integral part.

The two small pressure pad and head covers (C) which can be seen in Figure 1 at the center top must be removable. By casting a properly shaped rim on the panel, these covers can be fastened securely with only one machine screw. If the panel were not cast, this support and positioning flange could not easily be incorporated and the assembly would be considerably more expensive.

On the reverse side of the panel, Figure 2, all of the stiffening members are shown as



**3. ECONOMY and superior detail are reasons for die casting two smaller covers for head and pressure pad, right. All castings are sprayed with a synthetic lacquer and baked.**

well as mounting and positioning bosses (D). To maintain as uniform a section thickness as possible and cut down on the weight, the panel rim referred to above is cast as a depression on the underside. Entirely surrounding the panel, except along a portion of the lower edge, a heavier section is cast as a stiffening member (E).

Except for the small blind holes that are used as mounting holes, all others are cored. Both sizes and position as cast and trimmed are adequate for all cored holes.

Die costs for this panel are quite high, over $6,000 for the casting and trimming dies. However, when the complexity of the part is considered, this cost is not excessive. Further, based upon engineering estimates for other methods of making the panel, the lower cost of the die casting, ready for use is sufficient to amortize the cost of dies in a relatively short time.

Two other aluminum die castings used on the Ekotape recorder are shown in Figure 3 The covers for the head and pressure pad are exceptionally thin walled for a die casting. These covers, there is a left hand and a right hand one on each recorder, are used as received from the foundry. Die casting is used as a manufacturing method for economic reasons only For the same reason, the control handle is also an aluminum die casting. In this latter casting, two blind holes are cored. One of these fits the shaft of the control mechanism while the other one is drilled through and tapped after casting to take a set screw which holds the handle onto the shaft. Both of these castings shown are made by Madison-Kipp.

Finishing of all the castings thus far described is by spraying with a synthetic lacquer and then baking. This finish has all of the durability needed for the service and gives a more pleasing appearance than a polished or plated surface would have.

# IRON SINTERING provides a low-cost cam

HIDDEN away below the panel of this Webster instrument is another part of interest: the sintered cam shown at the left.

It is one of those parts dear to the heart of the powder metallurgist. The complexity of shape of this part is such that any other method of fabrication would be extremely expensive, yet for the powder fabricators, there is little difference between this part and one having simple contours once the dies have been built.

Die costs for this part are rather high, almost $1000, but are quickly amortized in the saving of manufacturing cost of the cam. The cam as made by the Chicago Powdered Metal Co. of Chicago, Ill., is a pure iron (copper-free) part and after molding and

sintering, is case carburized. This latter treatment is standard for powdered iron parts. About two hours in cyanide at 1550F followed by cooling to 1000F, reheat to about 1400F and quench in oil. Such a heat treatment gives a surface hardness that is file hard and a case depth of from 0.030 to 0.040. No further surface treatment is required.

"**. . . PERMANENT MOLD castings are used until the number of parts increases sufficiently to warrant the expense of die casting dies.**"

# Brass PERMANENT MOLD block doubles as electrical conductor

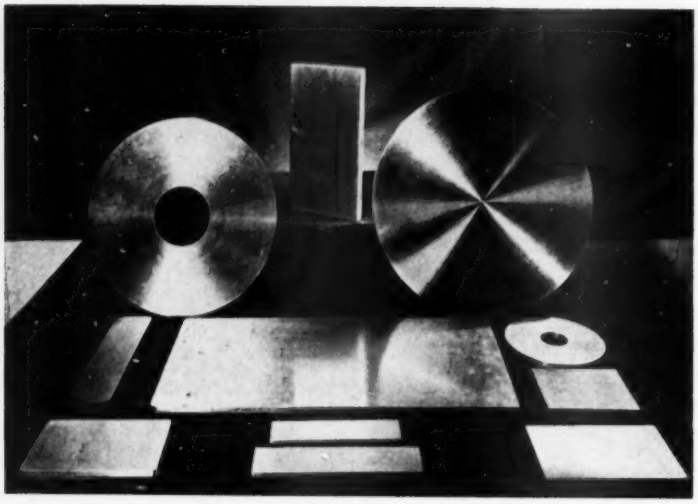
ACCORDING to Webster, the verb "attenuate" means to make thin, to lessen the amount, force or value of. It is precisely in this way that electronics makes use of an attenuator. By means of one of these devices a voltage is accurately reduced in a measured amount even though the amount of attenuation may be in the order of 1,000,000 to 1 or even more.

While the greatest degree of precision in an attenuator lies in the small electronic components, the block on which they are mounted must be held to relatively close dimensional tolerances. In addition, this block must be a good conductor of electricity and, because of the frequencies involved, conductivity is almost entirely on the surface. Silver is the most desirable material for this surface conductance and, hence, the base material must be such that it can be silver plated.

One type of attenuator made by the Elk Electronic Laboratories of New York utilizes a brass block fabricated as a permanent mold casting by the Kings County Pattern & Model Works of Brooklyn, N. Y. Two views of an attenuator block are shown in Figure 1.

Except for the small holes which are drilled and, if necessary, tapped after casting; all of the holes and the one slot are cored in the casting operation. Center-to-center distances are required to be within ± 0.003, somewhat closer than permanent mold casting can hold so that a reaming operation is required. The ends must be held parallel to each other within 0.005 and to insure this, both faces are machined before silver plating. In spite of a rather large amount of machining required, the use of permanent mold casting as a fabricating method is considerably less expensive than machining from bar stock would be. Most of this saving comes, of course, in the milling operations saved on the one end. As a final operation before plating with 0.0005 thick silver, the part is machined all over to give the desired surface finish.

This attenuator block is one of those examples where permanent mold castings are used until the number of parts increases sufficiently to warrant the expense of die casting dies. In some designs where relatively large numbers of the same castings are used, they are die cast in brass and practically all of the secondary machining operations are thereby eliminated.



# How large a part by POWDER METALLURGY . . . ?

By A. J. LANGHAMMER*

TWO questions that I am asked frequently are: "How large a part can be made by the powder metallurgy process?" and "How long does it take to sail the Mackinac Race?"

Let's first, briefly, discuss the latter. Here one must consider at least the wind (direction, velocity, steadiness), the boat (crew, navigators, sails), weather (fog).

Now as to large powdered metal parts.

A number of major factors are at once apparent including size, quantity, material, shape, and they rank in that order.

Unlike a sail-yacht race, the answers or results are readily computed and a conclusion reached.

First one determines the tonnage or press capacity required for the briquetting operation. If a press sufficiently large is not available, there is no need to go further.

In the interim, of course, you have in mind the economics of the application. This varies tremendously, and if the end result required cannot be otherwise obtained the economics involved need not be further considered. Next the quantity must be weighed. To date, designing engineers have not universally considered powder metallurgy for large parts.

Material is important in a number of ways — Should it be ferrous or non-ferrous? Is porosity mandatory or optional? Is the product a bearing, a machine part, a filter, a frictional unit, one of special electrical or electronic properties, anti-corrosive, high heat resistant, etc., etc.?

Naturally, the shape, too, must be considered, but in large parts finish machining may be employed without cost penalty. After all, in working with solid metal, patterns, dies, molds, heavy machine tools including at least lathes, milling machines, and boring mills are

*President, Amplex Mfg. Co., Subsidiary of Chrysler Corp.

**LARGE PARTS or small, can be made by powder metallurgy methods, with the press capacity and the know-how. Above are displayed some samples of both kinds, but they do not represent the extremes in either direction. On the facing page is arranged a group of large flat sinterings.**

involved. Frequently other types of machine tools are also necessary.

Now what does the term "Large" mean in powder metallurgy? Two factors are involved. One is the area, and the other the unit size.

The area determines the tonnage of press required. Should the part be 8" in diameter with a relatively small area of metal surface, it still must have a press with a sufficiently large table and die pot to accommodate the die assembly.

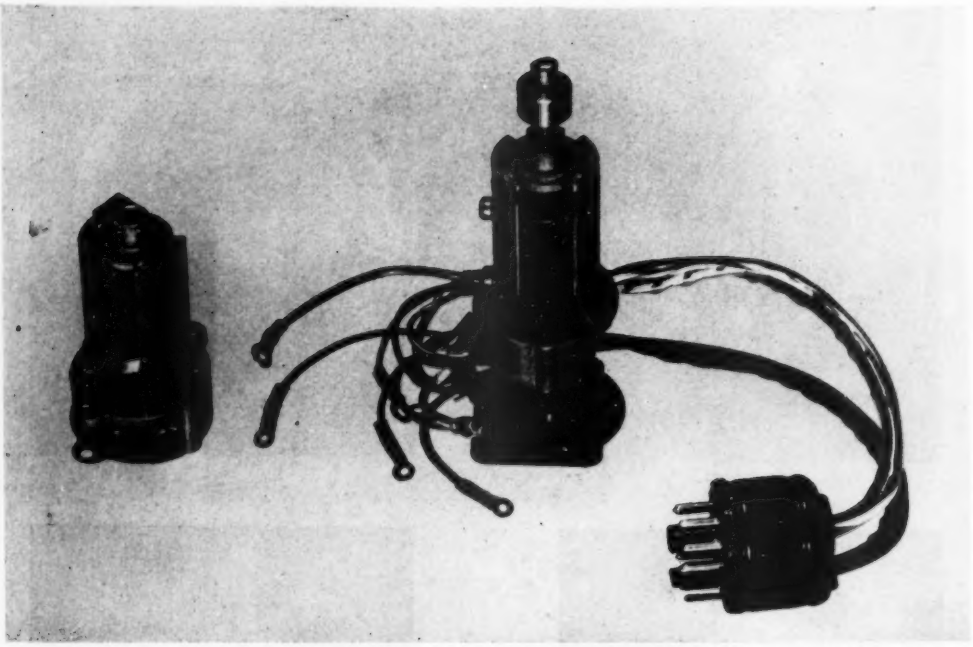
At this point, quantity again importantly enters the picture. How many pieces does the customer want? Up to this time quantities for parts 18" diameter are of modest proportion — ranging from 1 to 6 or as much as 2,500.

If the quantities are greater than 100 pieces, the part should probably be made on a special, automatic, hydraulic press. Presses of this type are rather expensive. Perhaps we should say something here of the cost of such a press. One of 500 ton capacity costs $150,000.00 in round numbers installed. Now automatic presses of this capacity, while not in those brackets, are still costly.

The question of tolerances is frequently raised. Briefly, with finishing by dies, tolerances are the same as specified for parts finished by normal machining operations. Generally, they increase with the size of parts and are readily maintained.

Of course, if the part is an Oilite bearing, the bore may be sized or finished economically to an exceptional degree of accuracy by a simple sizing or burnishing operation. Similarly a finish cut may be employed on the O. D. if dead true concentricity is required, though, as stated, normal machining tolerances are frequently acceptable.

continued on page 80



**ANALYSIS OF DESIGN** problems relating to this galvanometer dictated an investment cast aluminum housing. This piece is being cast by Arwood Precision Casting Corp.

# INVESTMENT CAST housing accurately locates magnetic elements

By O. W. PACKER*

IN conjunction with the proper amplifier and sensing unit the Sanborn recorder-assembly can be used to measure and record pressure, flow, frequency and a wide variety of other phenomena of industrial importance.

*Back of the recorder-assembly is a story of a galvanometer housing that exemplifies the high degree of versatility of the investment casting process.*

The galvanometer is the D'Arsonval moving coil type in which the coil in its own housing fits, as a unit, into the air gap of an Alnico-type permanent magnet. Since the moving coil, its suspension, the core, and related parts are a separate unit readily inserted into and removed from the permanent magnet, the characteristics of the entire galvanometer can easily be influenced by the design of and the accuracy of manufacture of the housing.

**Functional requirements:** When properly designed, there will be a maximum magnetic flux passing through the soft iron core inside the moving coil. To maintain the flux as high as possible, the housing must be non-magnetic. This requirement eliminates all ferrous materials except the austenitic stainless steels as materials of construction.

**Mechanical requirements** of strength in thin sections, temperature stability, and resistance to warpage or any aging effect eliminates plastics of all sorts. Further, since several small holes must be drilled and tapped and bore concentricity is important, a metal housing would be indicated.

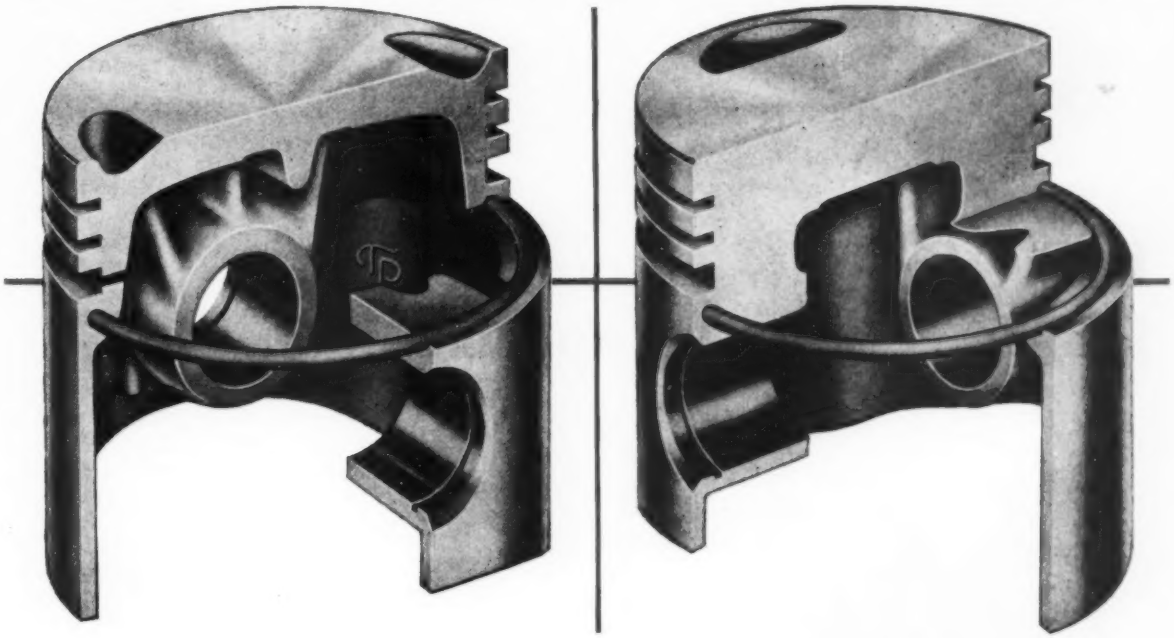
**Fabrication method:** As pointed out, the electrical characteristics of the galvanometer are dependent upon the accuracy and the design of the housing. Referring now to the

continued on page 71

*Chief Mechanical Engineer, Sanborn Co.

# Another First—by Thompson

# STEEL-BELTED PISTONS



The STEEL-BELTED PISTON, developed and introduced by Thompson Products nearly a decade ago, has a steel belt cast into the upper end of the skirt in such a way that it controls the thermal expansion under all operating conditions . . . a steel belt that controls the circumference of the piston at the top of the skirt.

The Thompson STEEL-BELTED PISTON is engineered so that it will not stick or score at any operating temperature in the engine. It has been *tested* and *proved* under every known condition to which a piston is subjected. It is being adopted by leading engine manufacturers. We solicit your inquiries regarding it as well as many other light metal castings that are a specialty of the Light Metals Division of Thompson Products, Inc., 2269 Ashland Rd., Cleveland 3, Ohio.

- New conception in aluminum piston design
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- Great strength

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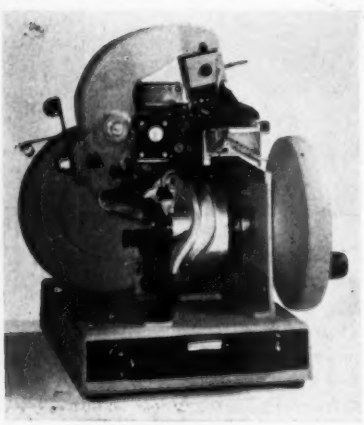
**1. SOME OF THE DIE CASTINGS which go into the Monarch Junior "60" ticket marking machine are indicated by arrows.**

# DIE CASTING . . . answer for short run of a special shape



**2. TRICKIEST PART to produce is the cam which controls the printing cycle indicated by arrows. Die cast 2-piece assembly has solved the problem.**

THE majority of the applications of die castings are those where a relatively large number of duplicate parts is involved. As a very rough rule of thumb, an annual production of 10,000 or more parts is sometimes taken as the dividing point. Below this level, the cost of amortizing dies is likely to count against die castings.

There are, however, many cases where, because of the complexity of the part, die casting can be used where only a very few pieces are needed. Such a condition exists in the case of the hand operated ticket marking machine, the Monarch Junior "60", Figure 1, manufactured by the Monarch Marking System Co. of Dayton, Ohio.

## Cam built of stampings is replaced by die casting

In the initial design of the machine, this cam was built up from a number of steel pressings. Because of design limitations, the part had to be positioned with the camming surface which operates the printing arm, in a vertical plane Figure 2. For a complete cycle, one revolution of the cam, the printing arm must be lowered onto the ink pad, raised to allow a ticket to be placed and then lowered again to print. During the part of the cycle where the arm was lowering to ink or print, the follower and cam surface were forced to maintain good contact. On the balance of the cycle, however, a tension

spring was required to pull the follower against the cam. Under normal conditions—lack of oil and collection of dust and dirt — the printing arm pivot would sometimes stick or become difficult to operate, with consequent breakage of the spring.

To offset this trouble, a new cam was designed having a rigidly fixed pullback on it. This cam is shown in Figure 3. While this change resulted in some improvement, the pivot would at times still stick.

*As can be seen, this new cam was an assembly of four sheet metal stampings, a machined hub and a tapered pin. The parts were held together by welding, riveting, and staking.*

This cam was expensive to manufacture and had the great disadvantage that positioning of the hub in the cam was always inaccurate. If a new cam had to be installed, the machine had to be returned to the factory so that the timing could be correctly set.

In an attempt to provide a more positive cam action and a part which could be installed in the field, the Monarch engineers in cooperation with the Precision Casting Co. of Fayetteville, N. Y., developed the die cast zinc cam shown in Figures 4 and 5.

*The superiority of the new cam is, at once, apparent. It gives a positive pullback under all conditions so that a spring is not necessary. Only two pieces are involved so that assembly costs are greatly reduced. The hub with its keyway are a portion of the casting so that alignment is no longer a problem and cams can be changed in the field.*

Where the old cam required drilling of the drive shaft for the tapered pin, the combination of a key and set screw hold the newly designed cam in place with better alignment and more positive locking than was previously possible.

**An awkward assembly of stampings and machined parts . . .**

**3. SECOND STEP in cam evolution was this fabricated steel cam with partial pull-back to ease the spring load.**

**. . . gives way to a 2-piece assembly of die castings.**

**4. BY INCLUDING a full-travel pull-back flange as part of the die castings, it has been possible to dispense with the spring.**

**5. SEPARATE DIE CASTINGS of which the cam is constructed are shown here in exploded view. Three machine screws hold them together.**

The only secondary machining operations needed on the die cast cam are to ream the bore and tap the set screw hole. The assembled cam is slipped onto a shaft and held against a form tool mounted in a drill

continued on page 58

# EXHIBITORS AT METAL POWDER SHOW ARE LISTED BY ASSOC.

LIST of exhibitors, except for the possibility of a few last-minute additions, has been completed for the 1953 Metal Powder Show which will attract engineers to Cleveland April 20-22. The show is under the auspices of the Metal Powder Association, holding their Ninth Annual Meeting concurrent with the show.

This pair of events will attract a large group of metallurgists, production men, executives, designers and research men interested in the rapidly growing field of powder metallurgy. Latest equipment and processes are to be displayed, along with representative sinterings produced by the major commercial fabricators.

Subject matter to be covered in the meetings which are open to the public, include: Application of metallic friction materials in heavy duty transmissions; flame plating; progress in development and application of sintered aluminum powders; refractory metal powders for high temperature work; brass powder developments; survey of powder metallurgy today; and electronic core industry outlook.

Exhibitors listed for the show, to be held along with the meetings at the Hotel Cleveland, Cleveland, Ohio, include the following:

Kux Machine Company; Metal Hydrides, Inc.; Electric Furnace Company; F. J. Stokes Machine Company;

Antara Chemicals Division, General Dyestuff Corp.; Arthur Colton Company; Magnetic Powders, Inc.;

Metals Disintegrating Company, Inc.; Lindberg Engineering Company; Ekstrand & Tholand, Inc.; Raybestos Division, Raybestos Manhattan, Inc.;

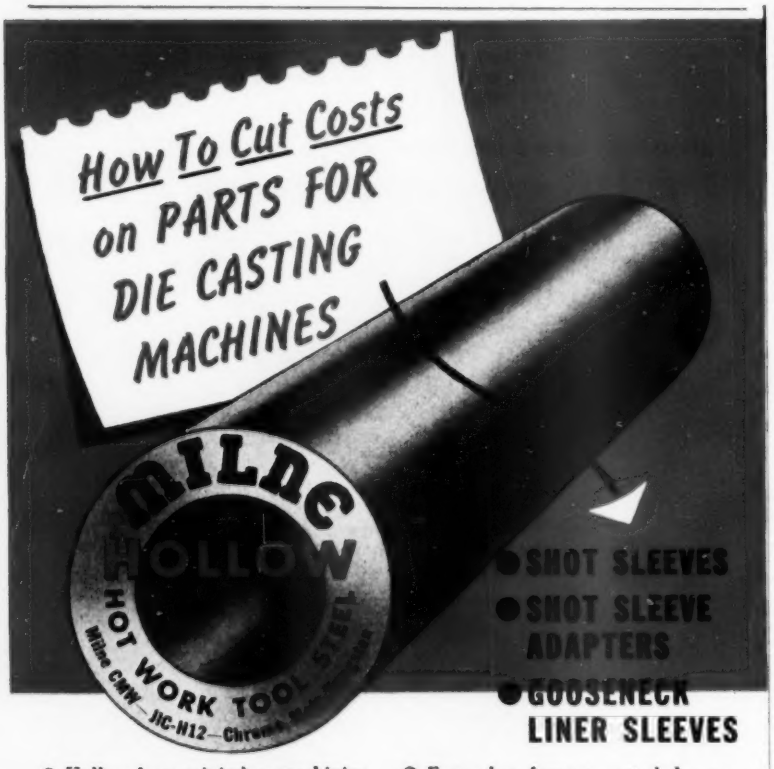
Charles Hardy, Inc.; Harper Electric Furnace Corp.; Glidden Company, Chemicals-Pigments-Metals Division; Plastic Metals Division, National Radiator Company;

Federal-Mogul Corp.; Easton Metal Powder Company, Inc.; Vanadium-Alloys Steel Company; New Jersey Zinc Company; American Sintered Alloys Div., Yale & Towne Manufacturing Company;

Powdered Metal Products Corporation of America; Powdercraft Corp.; Johnson Bronze Company; Precision Metal Molding magazine; Machine Design magazine; Materials & Methods magazine.

## SIMON STRAUSS NAMED

Simon D. Strauss, vice president and manager of sales of American Smelting & Refining Company, has been selected to be vice president of the mineral economics division of the American Institute of Mining & Metallurgical Engineers.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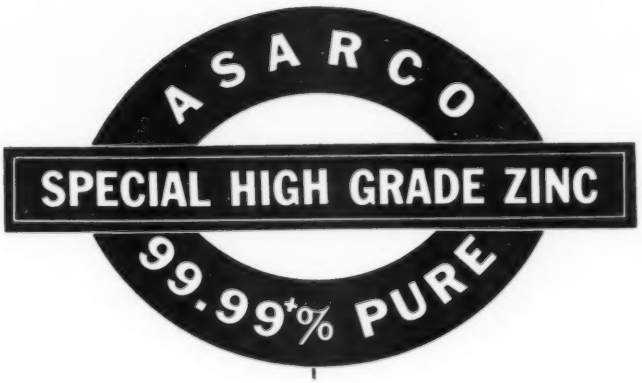


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# Chromium-Nickel Alloy Steel SINTERINGS: an investigation of physical properties

J. D. SHAW*, W. V. KNOPP*,
B. A. GRUBER**

THE current investigation was concerned primarily with the evaluation of three chromium-nickel alloy powders (i.e. 80% chromium — 20% nickel; 50% chromium - 50% nickel; 20% chromium - 80% nickel)[1] produced by Metal Hydrides, Inc. by the Hydride process[2] in combination with electrolytic iron powder and also in selected cases with electrolytic iron powder containing 1 percent added graphite.

*The fact has been widely recognized that the application of powder metallurgy to industrial parts is of a constantly expanding order and that this expansion currently is going on at a very rapid rate. The ferrous metallurgy field, in particular, has been extremely active and those engaged in making ferrous sinterings are constantly looking for new developments leading toward improved physical properties.*

**TABLE 1**

**Powder properties of chromium-nickel alloy powders**

| Alloy composition | 80% Chrom. 20% Nickel | 50% Chrom. 50% Nickel | 20% Chrom. 80% Nickel |
|---|---|---|---|
| **Sieve analysis** | | | |
| +100 mesh | 0.0% | 0.8% | 2.4% |
| −100 +150 | 1.8 | 4.5 | 15.7 |
| −150 +200 | 2.9 | 8.9 | 16.2 |
| −200 +270 | 5.1 | 11.0 | 17.8 |
| −270 +325 | 4.6 | 12.2 | 10.7 |
| −325 | 85.6 | 62.6 | 37.2 |
| **Apparent density, g/cc** | | | |
| By Scott Volumeter | 1.87 | 1.89 | 2.75 |
| By Hall Flowmeter | — | — | 2.70 |

**TABLE 2**

**Compact properties of chromium-nickel alloy powders**

**Conditions of preparation**

Compacting pressure — 50 tsi

Sintering conditions — 1100C (2012F) and 1200C (2192F) for one hour in hydrogen

| Alloy composition | 80% Chrom. 20% Nickel | | 50% Chrom. 50% Nickel | | 20% Chrom. 80% Nickel | |
|---|---|---|---|---|---|---|
| **Sintering temperature** | 1100C | 1200C | 1100C | 1200C | 1100C | 1200C |
| Green density, g/cc | 5.02 | 5.02 | 5.42 | 5.42 | 6.56 | 6.56 |
| Sintered density, g/cc | 6.44 | 6.89 | 5.41 | 5.95 | 6.69 | 6.71 |
| Tensile strength, psi | (1) | (1) | 15,700 | 26,100 | 29,100 | 34,300 |
| Elongation, % in 1" | - | - | 0.5 | 1.4 | 1.7 | 3.2 |
| Rockwell hardness | C-39 | C-54 | B-54 | B-81 | B-42 | B-46 |

Note (1): Test specimens too hard and brittle to test.

*An appreciable increase in tensile strength by the use of alloying constituents means that a sintering can be used as a stressed part in an application where iron sinterings of conventional compositions will fail under the applied load.*

The present art in the use of chromium-nickel-iron (and graphite) powder materials can be divided into three phases:

*(a) The combination of primary metals to form alloy compositions.* Nickel and chromium powders have been used in combination with iron powder (and graphite) to form alloy steel compositions. In general, the use of primary metals to form these alloys requires long time sintering at high temperatures to secure appreciable diffusion.

*(b) The use of fully alloyed chromium-nickel steel powders.* Alloy steel powders have been produced by thermo-chemical disintegration of alloy sheet and by atomization of powder from molten alloys of chromium and nickel in combination with iron. The thermo-chemical disintegration method is restricted to a relatively few alloys which will respond to such treatments. Limitations are imposed on atomization methods by such requirements as the necessity of the alloy having a melting point sufficiently low to allow atomization without excessive wear of atomizing nozzles and equipment.

*(c) The use of fully alloyed chromium-nickel powders in combination with iron powder.* The use of these powders is predicated upon the basis that when blended chromium-nickel alloy and iron powders (with or without graphite addition) are pressed and sintered, the chromium-nickel alloy will diffuse more readily than primary metals into the iron powder to form the specified alloy. If the characteristics of the chromium-nickel alloy powders (such as apparent density, particle size, and particle shape) do not appreciably differ from the iron powder to which they are added, no great modification in processing techniques is required other than those normally necessitated in the sintering of alloy steels.

It was decided that phase (c) offered considerable promise in expanding the use of alloy metal powders. The current investigation was initiated to evaluate the possibility of employing chromium-nickel alloy powders produced by the Hydride process in making alloy steels.

By this process, fine, pure primary metal oxides blended in correct proportions to form the selected alloy are thermally reduced by calcium hydride. Alloy powders of fine particle size, and of a wide range of compositions, can thus be produced. These powders, in addition to having a low oxide content, possess a relatively porous, irregular particle structure, are easily molded and readily blended with conventional iron powders.

The properties of the three chromium-nickel alloy powders are given in Table 1. The properties of compacts prepared from these alloy powders, using a pressure of 50 tsi and sintering conditions of 1100C (2012 F) and 1200 C (2192 F) for one hour in hydrogen are given in Table 2.

Certain interesting results, obtained on the compacts prepared from the straight chromium-nickel alloy powders, are

continued next page

**TABLE 3**

**Addition of chromium-nickel alloy powders to electrolytic iron powder**

**Condition of preparation**

Compacting pressure — 50 tsi
Sintering conditions—1100C (2012F) for one hour in hydrogen

**Powder composition**

Electrolytic iron powder* — chromium-nickel alloy (composition and % as noted)

| | Percent contained alloy | | |
|---|---|---|---|
| | 5% | 10% | 20% |
| **80% Cr. – 20% Ni.** | | | |
| Sintered density, g/cc | 6.93 | 6.75 | 6.60 |
| Tensile strength, psi | 42,900 | 54,800 | 61,100 |
| Elongation, % in 1" | 7.2 | 2.5 | 2.0 |
| Rockwell hardness | B-32 | B-54 | B-63 |
| **50% Cr. – 50% Ni.** | | | |
| Sintered density, g/cc | 6.98 | 6.82 | 6.63 |
| Tensile strength, psi | 29,100 | 39,100 | 46,200 |
| Elongation, % in 1" | 9.0 | 5.0 | 2.0 |
| Rockwell hardness | H-92 | B-49 | B-59 |
| **20% Cr. – 80% Ni.** | | | |
| Sintered density, g/cc | 7.09 | 7.12 | 6.87 |
| Tensile strength, psi | 31,300 | 36,200 | 33,000 |
| Elongation, % in 1" | 7.8 | 7.3 | 2.4 |
| Rockwell hardness | B-25 | B-42 | B-46 |

*The National Radiator Co., Plast-Iron, 100 mesh

*S-K-C Associate; ** Metal Hydrides, Inc.

**TABLE 4**

## Effect of sintering temperature and time on properties

**Condition of preparation**

Compacting pressure — 50 tsi
Sintering conditions—Temperature and time as noted in hydrogen

| Powder composition | Electrolytic iron powder — 10% chromium-nickel alloy (composition as noted) | | | | Electrolytic iron powder — 1% graphite — 10% chromium-nickel alloy (composition as noted) | | | |
|---|---|---|---|---|---|---|---|---|
| **Sintering temperature** | 1100C (2012F) | 1100C (2012F) | 1200C (2192F) | 1200C (2192F) | 1100C (2012F) | 1100C (2012F) | 1200C (2192F) | 1200C (2192F) |
| **Sintering time** | 1 hour | 2 hours | 1 hour | 2 hours | 1 hour | 2 hours | 1 hour | 2 hours |
| **80% Cr. — 20% Ni.** | | | | | | | | |
| Sintered density, g/cc | 6.64 | 6.66 | 6.56 | 6.64 | 6.75 | 6.76 | 6.80 | 6.78 |
| Tensile strength, psi | 66,100 | 95,300 | 89,000 | 88,100 | 54,800 | 69,400 | 55,200 | 63,500 |
| Elongation, % in 1" | 2.0 | 3.0 | 2.3 | 1.8 | 2.5 | 2.8 | 4.3 | 2.5 |
| Rockwell hardness | B-99 | B-95 | B-98 | C-28 | B-54 | B-72 | B-63 | B-69 |
| **50% Cr. — 50% Ni.** | | | | | | | | |
| Sintered density, g/cc | 6.89 | 6.88 | 6.91 | 6.97 | 6.82 | 6.82 | 6.79 | 6.87 |
| Tensile strength, psi | 60,300 | 80,400 | 86,500 | 121,000 | 39,100 | 50,800 | 45,700 | 54,400 |
| Elongation, % in 1" | 3.7 | 2.5 | 3.7 | 2.5 | 5.0 | 5.2 | 3.7 | 2.5 |
| Rockwell hardness | B-74 | B-89 | B-87 | B-99 | B-49 | B-66 | B-56 | B-66 |
| **20% Cr. — 80% Ni.** | | | | | | | | |
| Sintered density, g/cc | 7.11 | 7.14 | 7.10 | 7.10 | 7.12 | 7.09 | 7.15 | 7.01 |
| Tensile strength, psi | 72,200 | 68,600 | 78,800 | 82,200 | 36,200 | 36,900 | 34,700 | 37,700 |
| Elongation, % in 1" | 2.5 | 4.3 | 3.2 | 3.6 | 7.3 | 8.0 | 9.0 | 5.4 |
| Rockwell hardness | B-83 | B-84 | B-90 | B-93 | B-42 | B-31 | B-29 | B-45 |

**TABLE 5**

## Comparison of effects of heat treatment on properties of electrolytic iron powder plus alloys of varied chromium-nickel contents

**Conditions of preparation**

Compacting pressure — 50 tsi
Sintering conditions — 1100C (2012F) for one hour in hydrogen
Coining pressure — 50 tsi
Annealing conditions — 398.9C (750F) for one hour in hydrogen
Quenching conditions — held at 843.3C (1550F) for one-half hour; oil quenched

| Powder composition | Electrolytic iron 1% Graphite-10% Alloy (80% Cr - 20% Ni) | | | Electrolytic iron 1% Graphite-10% Alloy (50% Cr - 50% Ni) | | | Electrolytic iron 1% Graphite-10% Alloy (20% Cr - 80% Ni) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Condition of compact** | Tensile str. psi | Elongation % in 1" | Rockwell hardness | Tensile str. psi | Elongation % in 1" | Rockwell hardness | Tensile str. psi | Elongation % in 1" | Rockwell hardness |
| Sintered | 66,100 | 2.0 | B-99 | 60,300 | 3.7 | B-74 | 72,200 | 2.5 | B-83 |
| Coined | 63,000 | 2.0 | B-95 | 76,200 | 3.5 | B-88 | 76,300 | 4.6 | B-85 |
| Coined and annealed | 83,000 | 2.0 | B-95 | 76,300 | 3.5 | B-88 | 71,000 | 3.5 | B-84 |
| Coined and quenched | 84,400 | 2.0 | B-100 | 87,500 | 1.2 | C-30 | 76,900 | 1.7 | C-25 |
| Coined, quenched and annealed | 92,900 | 2.0 | B-96 | 89,200 | 1.1 | B-100 | 99,500 | 0.5 | C-15 |
| Quenched | 84,000 | 2.0 | B-97 | 90,300 | 1.2 | B-101 | 75,800 | 2.3 | C-19 |
| Quenched and annealed | 77,300 | 2.0 | B-95 | 78,600 | 1.2 | B-94 | 88,600 | 2.3 | C-16 |

given in the following paragraphs.

*80% Chromium — 20% Nickel Alloy* — The sintered compacts from this material were of such high hardness (Rockwell C-39 at the 1100C (2012F) temperature and C-54 at 1200C (2192F) that they could not be tested in the conventional manner.

*50% Chromium — 50% Nickel Alloy* — This alloy which is close to the eutectic composition, showed nearly a four-fold increase in tensile strength (from 15,700 to 56,100 psi) when some increase in hardness (from Rockwell B-54 to B-81) when the sintering temperature was increased from 1100C (2012F) to 1200C (2192F). Compacts of this alloy showed considerable shrinkage at the higher sintering temperature (1200C) (2192F) only; no appreciable shrinkage was observed at 1100C (2012F).

*20% Chromium — 80% Nickel Alloy* — The effect of increasing the sintering temperature from 1100C (2012F) to 1200C (2192F) produced an increase in tensile strength slightly under 18 percent from 29,100 to 34,300 psi) with relatively no change in hardness Dimensional changes upon sintering at both temperatures were of a minor order.

Tensile test specimens were prepared from combinations of the three chromium-nickel alloy powders, in amounts of 5, 10, and 20 percent contained alloy, with electrolytic iron powder[3]. All specimens were compacted at 50 tsi and sintered at 1100C (2012F) for one hour in hydrogen. Tensile strength, elongation, hardness, and sintered density values were determined for the three alloy compositions in each of the three given percentages. Test results are given in Table 3.

The results show an appreciable increase in strength over iron powder alone, prepared

continued on page 73

*These are just a few of the investment castings produced by Casting Engineers, Inc. at savings of at least 50% under cost of machining—a rate of 2 investment castings for the price of 1 machined part!

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**1. BENEATH a molded plastic exterior, this mixer gets the strength and ruggedness it needs from die cast zinc.**

# DIE CAST ZINC for stability and strength

By CHARLES B. LEE*

IN order to provide a smooth easily cleaned surface that is impervious to most corrosive materials found in the kitchen and, at the same time provide adequate electrical insulation, the housing of the Osterett, a small hand held electric mixer made by the John Oster Co., of Racine, Wis., is molded of plastic.

Flexible in application though the plastics may be, in the section thickness required, they have neither the physical strength nor the dimensional stability that is required to utilize them as structural components. The mixer is designed, therefore, with zinc die cast end bells that fasten to the motor stator. These end bells carry the entire load and act as aligning and fastening members for the motor and drive unit.

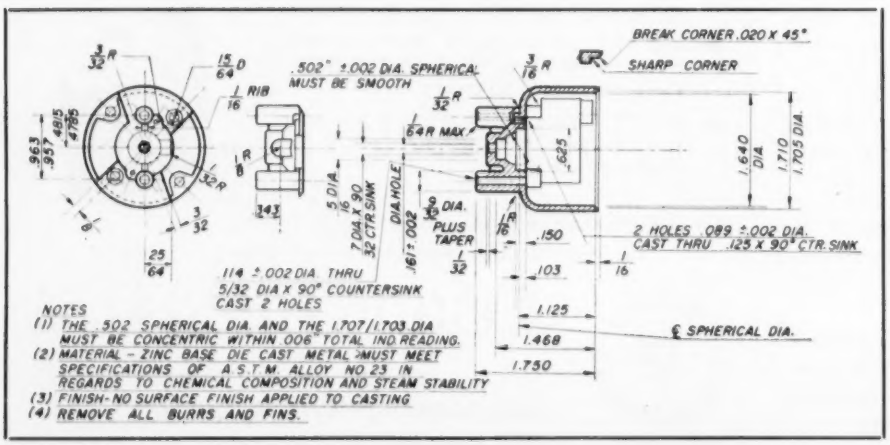
The design of the mixer is such that the plastic covering could be completely removed and the mixer used without it. It must be admitted that some comfort would be lacking if operated in this manner, and some electrical parts would be exposed.

The key to the design which enables the Oster Co. to make this small compact unit is in the two zinc die cast end bells made for them by the Modern Die Casting Co., of Chicago, Ill.

The use of die cast end bells for small motors is not new, but these two castings represent problems in coring that are some-

*Chief Engineer, John Oster Co.

continued on page 78


BREAK CORNER .020 X 45°
SHARP CORNER
.502" ±.002 DIA. SPHERICAL MUST BE SMOOTH
RIB
64R MAX.
1.640 DIA
1.710
1.705 DIA
.625
DIA. HOLE
PLUS TAPER
2 HOLES .089 ±.002 DIA. CAST THRU .125 X 90° CTR. SINK
.150
.103
1.125
1.468
1.750
℄ SPHERICAL DIA.
1.14 ±.002 DIA. THRU 5/32 DIA X 90° COUNTERSINK CAST 2 HOLES
NOTES
(1) THE .502 SPHERICAL DIA. AND THE 1.707/1.703 DIA MUST BE CONCENTRIC WITHIN .006" TOTAL IND. READING.
(2) MATERIAL - ZINC BASE DIE CAST METAL MUST MEET SPECIFICATIONS OF A.S.T.M. ALLOY NO 23 IN REGARDS TO CHEMICAL COMPOSITION AND STEAM STABILITY
(3) FINISH-NO SURFACE FINISH APPLIED TO CASTING
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**2. CLOSER ACCURACY than normal tolerances can sometimes be obtained, but will involve higher casting costs.**

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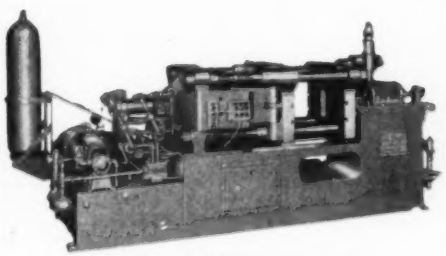

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## DIE CASTING INSTITUTE SEEKING NOMINATIONS FOR ANNUAL AWARD

The Award Committee of The American Die Casting Institute has invited nominations for the annual Doehler Award which is presented for the outstanding contribution to the advancement of the die casting industry.

The award, which is presented in September at the annual meeting of the Institute, is the highest honor granted by the industry, and goes to the individual or, group of individuals deemed to have contributed the most in the field of technical achievement, plant operations or other activities.

Set up in 1949 by the Doehler-Jarvis Corp., who donated a $25,000 fund in perpetual trust, the award consists of a plaque and a cash honorarium of at least $500.

Nominations are now being submitted to the award committee, which consists of the Board of Directors of the Institute. Nominations should be submitted to the award committee at the Institute headquarters, 366 Madison Ave., New York 17, N. Y., prior to April 30.

---

## ALAN CAZIER TO HEAD PMM WESTERN OFFICE

Alan T. Cazier has been appointed manager of the Western office of Industrial Publishing Company and will represent Precision Metal Molding magazine on the West Coast.

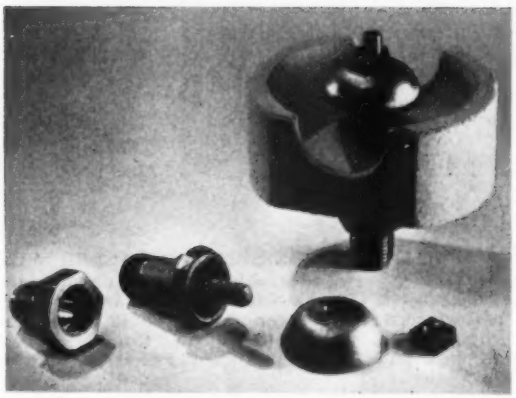
Mr. Cazier was previously representative of the company in the Ohio area and has had extensive experience in magazine production and editing. He served as an assistant editor on Die Castings magazine, now Precision Metal Molding, for more than a year before becoming Ohio representative.

He replaces Fred Frisenfeldt who recently resigned. Mr. Cazier will be located at 3259 Wilshire Blvd., Los Angeles 5, California.

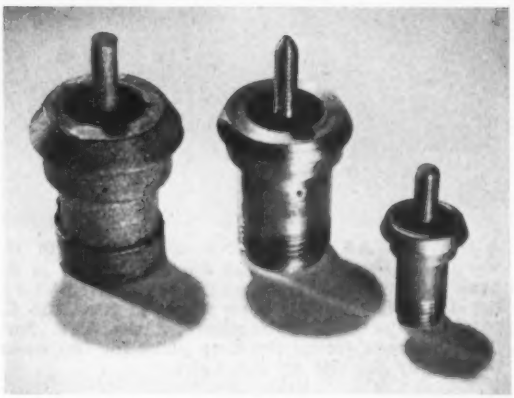
THE NICKEL-CHROMIUM ALLOYS are useful for solving many heat and corrosion problems. Now the investment casting process shows a way to produce smoother, more detailed pieces in these alloys at lower cost.

# Two-piece patterns used for heat-resistant INVESTMENT CASTINGS

By D. C. SCHEELE*



**1. INFRA-RED RADIATION from the surface of the refractory combustion bowl produces ambient temperatures up to 2300 F, although temperature at the investment cast burner thimble is about 1000 F.**



**2. EVERY EXTERIOR SURFACE on the sand cast thimble, left, was machined to establish concentricity and dimension. Only machining on the investment cast thimble, right, is the cutting of threads at top and bottom.**

*INVESTMENT castings in heat resisting alloy have been introduced into infra-red, radiant gas burners produced by Burdett Manufacturing Company of Chicago. They replace heavily machined sand castings of the same alloy.*

*In the two most widely used sizes of burners, the company has found it economical to tool up the burner thimble for investment casting.*

*To withstand operating temperatures, a 35-15 nickel-chromium alloy has been utilized. The burners produce an ambient temperature up to 2300 F, although temperature at the burner thimble remains in the neighborhood of 1000 F.*

## Principle of burner operation

Generation of infra-red rays (commonly known as radiant heat) is accomplished by raising the surface temperature of the burner refractory which can be seen in the assembled burner, Figure 1. The gas-air mixture is directed downward across the surface of the refractory combustion bowl, achieving almost complete combustion and heating the refractory to incandescence. Radiant heat from this surface travels through the air with negligible loss of energy.

This heating system is used for batch and conveyor type drying ovens, mold drying, and similar applications. Its advantages include

*Chief Engineer, Burdett Manufacturing Co.

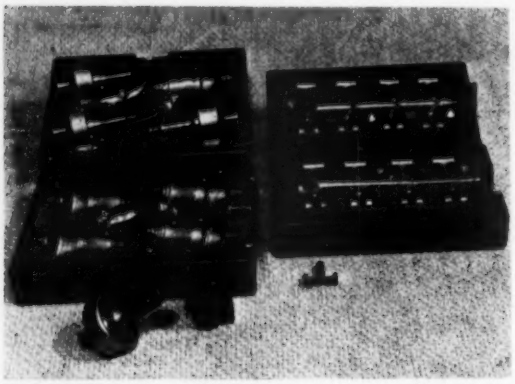
rapid transfer of heat by radiation, lower cost of fuel due to high combustion efficiency and greater uniformity of temperature.

### Construction of the burner

The gas-air mixture is fed through the hollow nickel-chrome thimble, striking a baffle plate mounted on top of the thimble. It is then deflected downward where it "scrubs" the surface of the refractory combustion bowl, burning completely.

The lower end of the thimble is threaded to receive a bushing which holds the combustion bowl in position against a shoulder on the thimble.

A stud at the top of the thimble is threaded to receive a stamped baffle plate and nut. By threading the baffle plate up or down, the orifice through which the gas is fed can be adjusted for the specific type of gas being burned.



**3. TWO WAX PATTERNS are formed in the dies shown above. The die on the left is the basic pattern die and shows the cores assembled in the die. One core has been removed from the die to show the contour formed by the core. Note that this core forms the core print for the insert formed by the die on the right.**

### Investment casting and sand casting compared

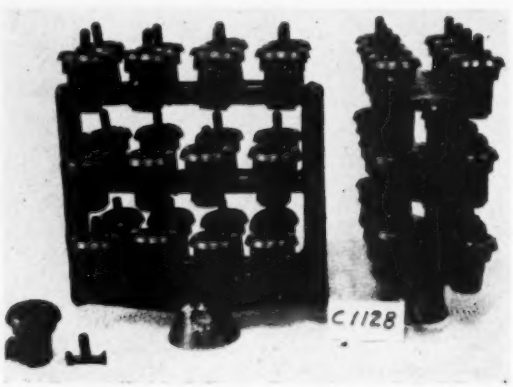
In Figure 2 are displayed an investment cast burner thimble and the sand casting which it replaces. It can be observed that the sand casting has been machined on every exterior surface. Only machining on the investment casting is the cutting of threads at top and bottom.

Despite somewhat higher price of castings, the investment cast thimble is about 35 percent less than the sand cast piece when all secondary costs are calculated into the price. Most of the difference can be traced to the elimination of machining.

Concentricity between the stud which holds the baffle plate, and the outer rim of the flange over which the gas-air mixture flows, must be held quite close. This assures uniform orifice width all around. This could only be achieved by substantial machining of the sand casting, but requires no machining on the investment casting. The stud is threaded, but does not need to be hollow milled.

Excessive loss of scrap, rough appearance, and opening up of blow holes have been other deficiencies of the sand casting which are now eliminated. Costs of cutting tools have also been saved.

The inside surfaces of the investment casting are just as smooth as the outside, and contours of the thimble have been designed for improved gas flow characteristics. Even the cross-piece from which the upper stud projects, has been designed with airfoil section to reduce turbulence in the gas stream. This was impossible with a sand casting.




**4. THE INSERT HAS BEEN ASSEMBLED to the basic pattern, assembled into the cluster, and are ready for processing. Without the two-piece pattern assembly, lower left, it would have been impossible to produce this burner thimble. Photos on this page courtesy Misco Precision Casting Company.**

The key to the successful production of these thimbles is the two-piece wax pattern. The main body of the thimble is produced from one die, while the cross-piece and stud are produced from a second die. These dies, together with the core and the two wax patterns, are illustrated in Figure 3.

The core used to form the inside of the pattern of the thimble body also forms core prints into which the pattern for the cross-piece fits. Close accuracy of the core print helps maintain concentricity tolerance, as noted above.

When the two pieces which compose the pattern have been fastened together, they are mounted in clusters, as shown in Figure 4. By "treeing" 24 patterns to be included in a single flask, maximum economy is achieved.

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# Finishing Section

## SURFACE FINISHING

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|---|---|---|
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| ALOXITE TPT Aluminum Oxide | Tough, sharp. Grits 16 through 100. | Polishing operations involving removal of large amounts of metal (e.g. plowshares). |
| ALOXITE TPL Aluminum Oxide | Very sharp, friable. Grits 16 through 220. (It fractures during use, thus reduces loading of the wheel surface). | Polishing low tensile strength metals—copper, brass, bronze, aluminum. |
| ALOXITE TPC Aluminum Oxide | Medium sharp. Grits 16 through 220. | General purpose polishing grain—for removal of small amounts of metal. |
| ALOXITE TPW Aluminum Oxide | Powder. Grits 240 through 1000. | As the abrasive in paste heading of polishing wheels and belts. |
| CARBORUNDUM RA Silicon Carbide | Sharp, very friable. Grits 10 through 240. | Polishing cast iron. |
| CARBORUNDUM RA Silicon Carbide | Powder. Grits 280 through 600. | General purpose polishing. |

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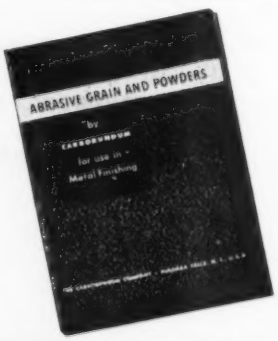


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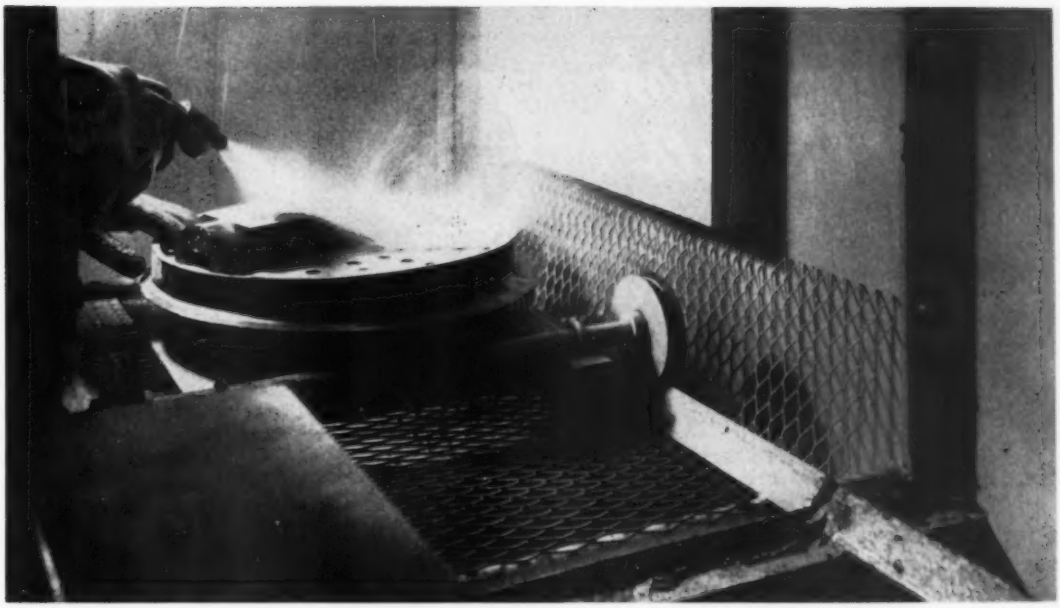

**INSIDE BLASTING COMPARTMENT of a wet blasting machine equipped with work car and rotating table for heavier dies. Photos courtesy American Wheelabrator & Equipment Corp.**

# WET BLASTING as a method of surfacing die casting dies

**By EUGENE F. ANDERSON***

*RECENT developments in the field of wet abrasive blasting have brought about some rather interesting improvements in the cleaning and finishing of die casting dies. Although wet blasting is one of newest cleaning processes, its gain in popularity has been steady because it offers such close control over surface quality. It makes possible new economies in both the manufacture of new dies and in the maintenance and redressing of old ones that become dirty from use. Savings in surfacing time of at least 10 percent on new dies are typical, because manual polishing requirements are eliminated.*

Die finishing has in the past been done completely by means of manual methods involving the use of various grades of abrasive papers, sticks, wheels, and stones, but these methods are slow because of the several steps which need to be taken. First, coarse abrasives need to be applied, then finer and finer sizes, until the desired surface quality is obtained. Obtaining desired finishes by these means after grinding and machining naturally requires a considerable amount of time, and additional time is needed for knurled dies or those having many crevices, since polishing stones and sticks need to be periodically pointed.

Another disadvantage is that hand-polished dies often produce castings which have cold spots, shiny spots, and flow marks on them, and since the majority of die castings are to be either plated or painted,

*Special Engineer, American Wheelabrator & Equipment Corp.

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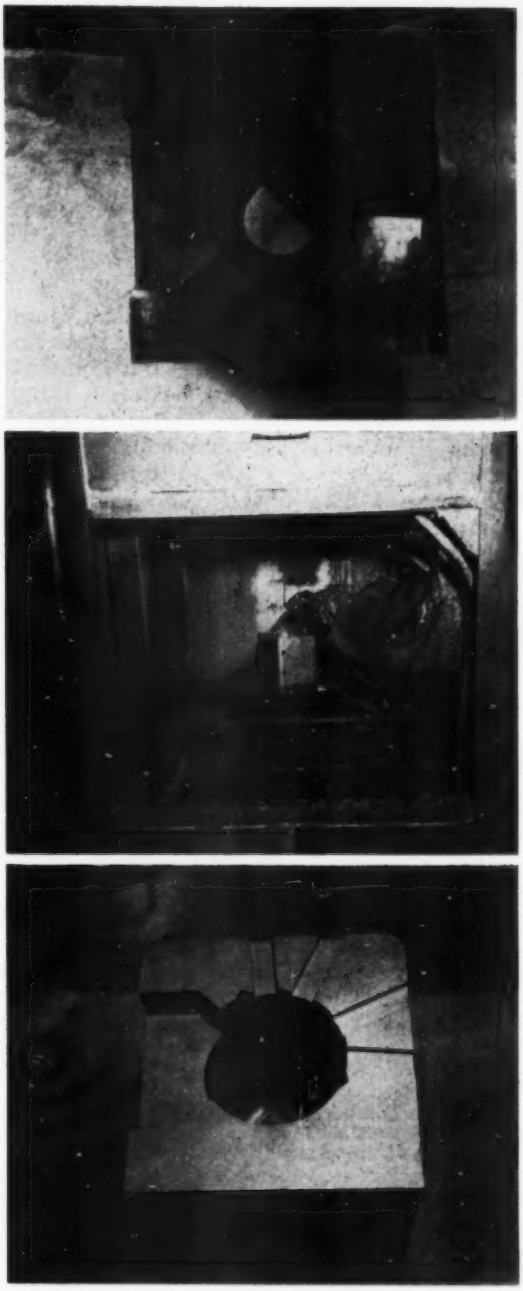
considerable time must be spent in buffing the castings.

Satin matte finishes, which are produced by wet blasting, improve molten metal flow across the die faces, so flow marks, cold spots, etc., are almost always eliminated by wet blasting. Reduced pressures during casting are also possible, and the break-in time of new dies is practically non-existent. A wet blasted die has all of the surface imperfections and directional lines blended and an identical surface is usually reproduced on the casting, so where a satin chrome finish on a plated casting is satisfactory, a casting produced by a wet blasted die can be plated without buffing.

Since satin matte finishes have more surface area than do mirror finishes, an extremely strong plate-to-metal or paint-to-metal bond results. If a glossy chrome surface is important, a small amount of buffing is first required on the casting, but buffing time to produce a lustre is appreciably reduced because a casting already has a uniform surface. Castings produced from wet blasted dies are silver in color, while those from hand polished dies are white, but this usually produces no complications.

With wet blasting, tolerances on work are easily held within .0001 of the original die dimension. Sharp edges and corners in dies are not rounded during cleaning and finishing, and any lines or lettering that are built into patterns remain unchanged. Complete cleaning can be accomplished on knurling without dulling the sharp points.

In view of this, most die casting dies are finished for dimensions as much as possible right after hubbing or machining is completed, and before blasting, as it is unnecessary to leave any extra metal to compensate for the wet blasting operation. After the die has been hardened, the scale is wet blasted off, and the die is usu-



**SCALE-COVERED DIE shown in the top view has been taken from a die casting machine after a production run on food mixer covers at Midwestern Die Casting Company of Chicago. View of the die being wet blasted with 325 mesh abrasive appears in the center. This cleaning took place at Perfection Tool and Metal Heat Treating Company of Chicago. Below is a view of the same die completely cleaned and ready to go back into production.**

ally immediately ready to be put into service.

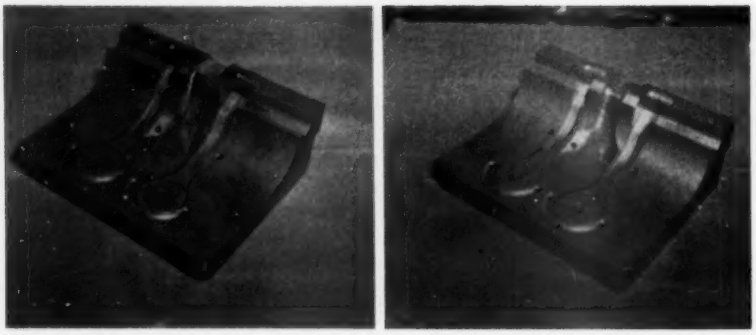
The wet blasting process has a wide application in the maintenance of dies, for such work as removing the carbonaceous material that forms on the die surfaces during use. Jointed dies usually have to be disassembled when manually cleaned, so that all areas, corners, and crevices can be completely cleaned, but with wet blasting, maintenance workmen find that only partial disassembly is necessary at most, unless the dies are large and heavy enough to be unwieldy in handling. Wet blasting makes die repairing easier, since matte surfaces produce no glare under lights, and are therefore less tiring to work on than are highly polished surfaces.

## The wet blasting process

The process is essentially one in which fine-mesh abrasives, suspended mechanically in water, are hurled upon the work at high velocity. The operation is done in metal cabinets, sized according to the requirements of the job, and the slurry mixture is propelled at the work through a gun by means of compressed air at a pressure of from 80 to 100 psi.

The operator stands outside of the cabinet with his arms extended through armholes on the front of the machine and manipulates the gun and work inside the machine with his hands while operating the compressed air valve with his knee. The abrasive gun is held approximately 1½ to 2 inches from the work and at an angle of around 60° with it.

During the wet blasting operation, the operator is able to view the progress of his work through a vision window, and he inserts work into the cabinet and removes it through doors on the ends of the cabinet. However, with small dies, the operator can save himself a considerable amount of time



**BEFORE AND AFTER view of a die used by Abco Mold & White Metal Casting Company of Chicago, for casting towel rack ends. At left is the die before cleaning, and at right, after a 10-minute cleaning.**

by simply inserting and removing them through the armholes, if they are constructed so that the gloves he wears are unattached to the gauntlets. Unattached gloves have been more popular than attached gloves for this reason as well as for reasons of health, since it is possible for each workman to have his own pair of gloves for avoiding contagious skin diseases.

Various types and models of machines are available for the blasting operation, and various kinds of accessory equipment are to be had, depending upon the requirements of the work. The machines range in size from bench models to large floor models. For most die casting work, a floor model about four feet in length and three feet in width is most satisfactory; however, where big dies are to be handled without disassembly, a larger machine is needed. For this work, machines about 6 ft. in length by 4 ft. in width can be used.

The work conveyor inside the machine depends upon the requirements of the job. Where only small dies which can easily be lifted and turned by hand are to be cleaned, no work conveyor at all is employed. An expanded metal floor in the blasting compartment serves as a work platform, and the operator turns the work over by hand.

Where heavier dies are to be cleaned, the cabinet is provided with tracks and a workcar which runs on them. This car can be equipped with a rotating turn table, which facilitates manipulating the work in front of the gun.

After the blasting operation, the dies are rinsed, either in hand rinse tanks or over a power rinse tank, with rust inhibited water being used. The hand rinse tanks are meant for the lighter dies that can be easily handled by hand. These tanks are usually made available in pairs, one compartment for receiving the part immediately out of the blast chamber, and the other for a final rinse.

For the heavier dies, power rinse tanks are available which have tracks on which the work car can be drawn out from the blasting compartment. The tank is filled with water and inhibitor, and a coolant-type pump raises the water through a hose. Power rinse tanks are convenient when chain hoists and other devices are needed for loading heavy work.

Both the hand rinse tanks and the power rinse tanks are available with immersion-type water heaters. Hot water makes parts dry faster with less chance for oxidation.

Special types of abrasives and chemicals are needed for wet blasting, but because of the popularity of the process, it is now possible to obtain all sizes of the various types of abrasive needed, plus necessary rust inhibitors and anti-packing chemicals, directly from manufacturers' stock. Considerable research has been done for determining type and size of abrasive to be used for various applications.

It is well to recognize that special problems require special treatment, so it is best to submit any kind of work to a manufacturer's demonstration laboratory where abrasive requirements can be determined by actual tests.

**TO ACCOMMODATE heavier dies, this wet blast machine has a work car which rolls out into rinse tank. Rotating work table makes manipulation of die easier.**

# PROMOTIONS and APPOINTMENTS

Four new executives have been named at the Chicago plant of *Taco West Corp.* They are CHARLES T. LAECHELT, purchasing agent; ARDMORE M. WILLER, assistant sales manager; EDWARD O. MARQUARDT, cheif mechanical engineer; CHARLES B. KARCH, production manager.

J. H. BRUNN has joined *Hooker Electrochemical Company,* Niagara Falls, as director of research.

DAVID L. GAMBLE has been appointed manager of research by the *New Jersey Zinc Co.* to succeed GEORGE F. A. STUTZ who has been transferred to the New York office as development engineer. ROBERT K. WARING has been advanced to assistant manager of research.

Among a large number of personnel changes made by *Vascaloy-Ramet Corp.* of Waukegan, Ill., as part of an extensive plant expansion program, are the following: GEORGE T. BRENNAN, works manager; PAUL J. GUENTHERMAN, general superintendent; LEO PALUSKA, purchasing agent; CLIFFORD J. NAUTA, manager of sales promotion and publications; DWIGHT F. CLARK, sales manager of investment castings.

*American Cyanamid Co.* announces two new appointments in its Metal Chemicals Section of the Industrial Chemicals Div., PAUL J. KONDLA was named Eastern Regional Representative, replacing A. E. BROADY who will serve as representative in the Cleveland, O. district.

Appointment of CHARLES E. GLENNON as sales engineer for the *Platecoil Div.* of the *Kold-Hold Mfg. Co.* has been announced. Glennon was previously with the U. S. Army, Chicago Chemical Procurement District as chief of the industrial division and production engineer.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The Groov-Pin is primarily a cylindrical pin cut from bar or coil stock. Longitudinal grooves are rolled or pressed into the body to deform the stock within controlled standard limits.

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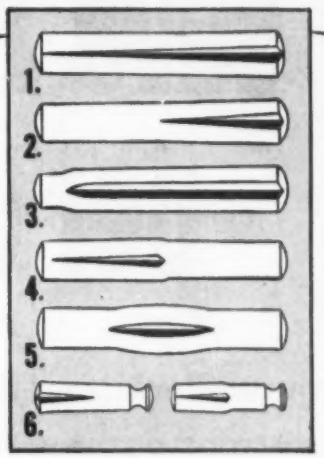
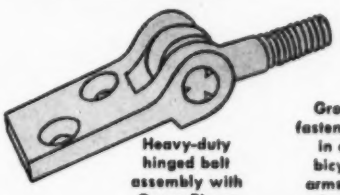
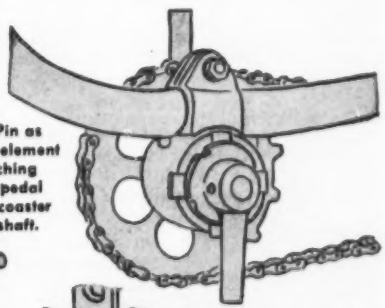
The Groov-Pin is simple in design, efficient, economical both in price and in cost of application, and it is versatile in its uses. This combination of advantages has never been surpassed by any other pin fastening. It is true even though Groov-Pins have been in use for over a quarter-century, essentially in their present form from the beginning. Like the common pin or nail the original design of the Groov-Pin was fundamentally perfect. Therefore, improvement has been impossible. Groov-Pins are assembled in straight drilled holes. No tapping, reaming, peening or milling are required. They can be driven by hand hammer, air cylinder or hydraulic press.




1. Full length taper Groov-Pin.
2. Half length taper Groov-Pin.
3. Full length parallel Groov-Pin.
4. Half length reverse taper Groov-Pin.
5. Center Groov-Pin.
6. Half length taper and reverse taper Groov-Pin with annular grooves for spring retention.



Heavy-duty hinged bolt assembly with Groov-Pin as hinge pin.



Groov-Pin as fastening element in attaching bicycle pedal arms to coaster brake shaft.

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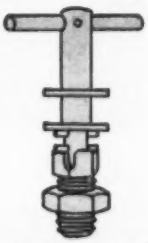
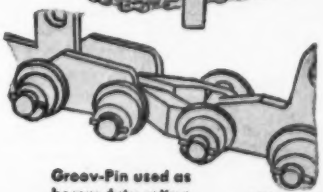


Groov-Pins used as locating and stop pin and for locking handle in pressure relief valve stem.



Groov-Pin used as heavy duty cotters on heavy chain links.

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SPECIAL SHAPES
continued from page 39

press to clean up any flash in the cam groove. Generally, this latter operation is not required, but is carried out as a precautionary measure.

One might expect that a zinc die casting would have less satisfactory wear resistance than a steel cam. There is some wear, but life tests have shown that after 1,000,000 cycles (about ten years normal service life) the die cast cam is still in operating condition, considered adequate by both the manufacturer and customers.

While the number of cams made per year cannot be disclosed, the total annual production is far below any normal usage of die castings. In spite of this low consumption, however, there has been a reduction in cost of the cam, ready for installation, of almost 27 percent. In addition, there has been a further saving in installation costs and, more importantly, improved customer satisfaction and lowered service charges.

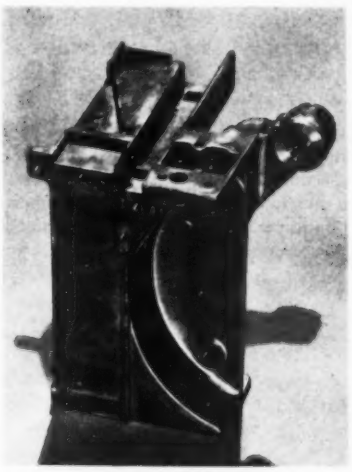
### How a die cast frame pays off

The older machines had a cast frame, onto which were fastened various appurtenances all of which, when assembled, made up the main machine frame. This assemblage was expensive to manufacture and assemble and not as rigid as could be desired.

When redesign of the machine was undertaken, one of the aims was a better and less expensive frame. Working again with the die caster, in this case the Superior Die Casting Co. of Cleveland, Ohio, a new frame design was developed which is a single aluminum casting onto which every other part of the machine can be fastened without having any separate frame members, Figure 6.

There are several notable features about this frame. In the first place every hole, slot, groove, etc., that is required is cored except for one slot put in as a secondary operation. All round holes are cored so that tapping only is required except for the main drive shaft bearing hole which is generally reamed to secure a press fit on the self-lubricating bearing.

In a number of places good design or operation dictated a blind rectangular hole or a



**6. EXCEPT FOR ONE SLOT, every hole is cored into this complex-shaped frame.**

blind slot. These could not be machined in when the older design was in use, but are easily cored in the die cast frame.

Thin and thick sections are in juxtaposition, a condition to be avoided in any casting, but successfully accomplished in this case. Considering that the casting is of aluminum, it is an even greater accomplishment.

Since this frame is an entirely new design, there are no costs available for comparison between the die cast unit and any other. Engineering estimates, however, indicate that any comparable frame made by machining of a basic casting (that is a sand casting) would be several hundred percent more costly and would be a far less desirable unit.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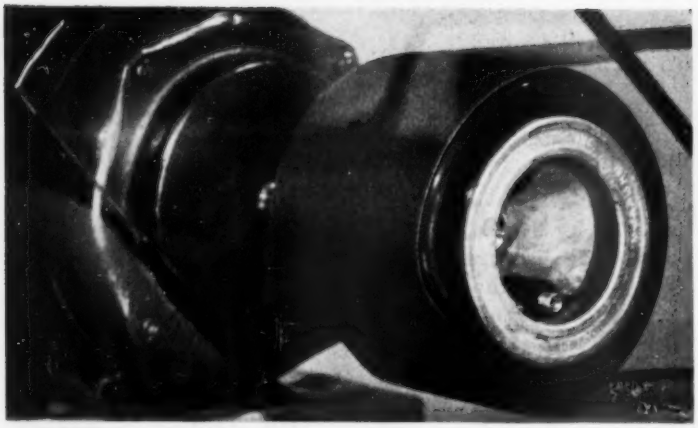


**GREATER AREA of contact is possible through the use of air inflated contact wheels. Varying the air pressure changes the area of contact.**

As an adjunct to, rather than as a replacement for solid contact wheels, the air inflated contact wheel will perform some jobs better and faster than other types. This is particularly true in finishing castings where irregular surfaces and hard to reach spots are the rule rather than the exception.

# AIR-INFLATED CONTACT WHEELS
## extend range for abrasive belts

**By ARTHUR RASKE***

FOR the rapid removal of metal such as gates, sprues, risers and vents as well as for general sanding and polishing of plane and irregular surfaces, rubber contact wheels with a sanding sleeve or, in conjunction with a backstand idler, a sanding belt is normally used.

The hardness of the wheel can be varied over rather wide limits by varying the compounding of the rubber. This change in hardness is essential to permit accommodation of a wide variety of work, but means that whenever a wheel of different hardness is needed, the setup must be changed. These contact wheels are normally a solid rubber tire, mounted on a metal wheel or mandrel.

To provide an almost infinitely variable hardness without having to change from one wheel to another and to provide a much greater surface of contact between the work piece and the abrasive sleeve or belt, an air-inflated contact wheel has been developed by the Nu-Matic Grinders, Inc. of Cleveland, Ohio.

The new type of wheel consists of a plastic or metal core with zinc die cast end plates and a rubber sleeve held between the end plates by clamping bolts. The design of the core and end plates is such that compressed air can be introduced into the annular space between the core and the rubber sleeve.

By varying the air pressure in the annular space from just

*Vice President, Nu-Matic Grinders, Inc.

above atmospheric pressure to a maximum of about 10 psi, the hardness of the wheel can be varied over the entire range that is normally used by having different wheels of varying durometer hardness. These wheels are made in varying sizes from about 3½ inches diameter to 8 inches diameter with either 3 or 3½ inch wide face. Either a smooth or serrated wheel can be made.

Since the maximum pressure used in the air-filled wheels is only 10 psi, inflation is easy. In shops where compressed air is available at the various machines, inflation is accomplished by providing a hose connector that will accommodate the type of valve found on inner tubes. Where no compressed air is available, or for use on portable tools, a small hand pump such as those used for bicycle tires is adequate.

Mention was made above that these wheels will readily distort to irregular shapes so as to give a greater area of contact between the work and the abrasive. The illustration shows how a wheel flattens when a plane surface is pressed against one of the wheels. This same effect of change in wheel contour is accomplished when curved surfaces are being sanded or polished. The ability to conform to the surface is of special importance when finishing irregular-contoured die castings.

Depending upon the type of work being done and the kind of metal, the rate of metal removal is from 100 to 500 percent faster than with the conventional wheel. A portion of this increased speed of metal removal is due to the greater area of contact (up to 3000 percent) between the work and the abrasive.

A secondary feature is that due to the rather sharp angle where the belt normally leaves the work, there is a far greater self-cleaning action, thus preventing loading of the belt. Under normal usage, the loading of the belts is so slight that the abrasive coating can be almost completely consumed without attempting to clean or otherwise recondition a belt.

The soft conforming wheel eliminates all chatter and bounce and, in some cases these wheels have replaced disc type sanders with consequent elimination of swirl marks common to discs.

Even very thin edges, such as the edge of thin plates and strips, can be successfully polished; the air inflated wheel conforms to the edge or corner.

---

**NEW STEVENS PLANT**

Frederic B. Stevens of Canada, Limited have announced the completion of new plant facilities in their Windsor, Ontario buffing composition plant.


**FREE!**

**61 PAGES OF FACTS FIGURES PHOTOS ON BARREL FINISHING**

Get the complete story! Learn about latest developments in equipment, compounds, abrasives. Amazing results now possible on almost all types of parts from large castings to small intricate parts.

Write Today For 3 FREE Booklets D-3

ALHCO Supersheen

AMERICA'S LARGEST MFGR. OF ADVANCED BARREL FINISHING EQUIPMENT, MATERIALS & COMPOUNDS

ALBERT LEA, MINNESOTA

*Circle No. 93 on the Reader Service Card*

**DIES Last Longer when you CLEAN 'EM with Pangborn HYDRO-FINISH®**

MOLD and die tolerances are held to .0001" when you clean and finish them with Pangborn Hydro-Finish. Fine-mesh abrasives suspended in water do a precision job . . . there's no danger of excessive metal removal . . . no danger of expensive equipment being ruined!

What's more, Hydro-Finish saves you more money because it saves time and labor! Operated by one man, a Pangborn Hydro-Finish machine removes scale and discoloration in *minutes* instead of hours. And, cleaned surfaces are virtually free of directional grinding lines, eliminating or reducing further finishing operations.

***GET THE FACTS*** on Hydro-Finish and how it can help prolong the life of dies and save you money! Write today for Bulletin 1400-A. Address: PANGBORN CORP., 3500 Pangborn Blvd., Hagerstown, Md.

***Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment.***

Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job

*Circle No. 79 on the Reader Service Card*

# USEFUL LITERATURE

**To receive copies of the publications described here circle key number on reader service card bound in this issue.**

## PROCESSES

**New Plant Produces Stainless Steel Shell Moldings: No.144**

The new shell molding process for producing stainless alloy castings has been introduced on the West Coast by Solar Aircraft Company whose facilities for contract shell molding are introduced in a new booklet. Solar produces castings from shell molds in 300 & 400 series stainless steels, N-155, Inconel and Hastelloy C. Size of castings ranges from 1 ounce to 350 lbs.

## MATERIALS & EQUIPMENT

**Carbonyl Iron Powder: No. 150**

Technical book on carbonyl iron powders gives characteristics and applications. Told with photomicrographs, diagrams, charts and tables. Contains 3 pgs. of bibliography. From Antara Chemicals Div.

**Technical Help on Powder Metallurgy: No. 151**

How the technical and production staffs of Metals Disintegrating Co., Inc., came to the assistance of a chief metallurgist for manufacturer of sinterings faced with a special problem, is related in a folder from the company. It not only tells of technical service, but lists metal powders available from the company and lists distributors.

**Steel Fire Partition: No. 152**

A new brochure from Virginia Metal Products Corp. tells about an Underwriters' Approved one-hour movable steel fire partition. Withstands one-hour temperature & hose stream fire test.

**Holding Furnace & Pumping Unit for Die Cast Alloys: No. 153**

Operation and characteristics of a new combination induction holding furnace and pumping unit for die casting aluminum and zinc alloys has been released by Ajax Engineering Corp.

**Reference Data on Die Casting Alloys: No. 154**

In a compact fold-out chart, Samuel Greenfield Co., Inc., offers reference data on zinc & aluminum die casting alloys. Included are composition, typical properties & characteristics.

**Art of Casting: No. 155**

In an elaborately prepared 38-pg booklet from American Car & Foundry, photographs and descriptions of their foundry operations are portrayed. Included among ACF products also introduced in the booklet are goosenecks for aluminum and zinc die casting.

**Chart Explains Magnetism: No. 156**

A new chart, "What Makes a Magnet?", describing the natural forces causing magnetism and how they are used industrially is offered by Eriez Manufacturing Co. Seven sections of the chart explain potential magnetic forces found in a ferromagnetic atom and how natural forces are organized by applying an external magnetic field.

**Swiss Die Casting Machines: No. 158**

Folders giving complete specifications and descriptions of three Swiss-built die casting machines are available from Buhler Brothers, Inc., American representatives of the Swiss concern. Two cold chamber and one gooseneck hot chamber machine are included.

**Zinc Stearate as a Powder Metallurgy Lubricant: No. 159**

A data sheet from American Cyanamid gives pertinent information concerning the company's zinc stearate as a lubricant for powder metallurgy. Less stearate is needed for good lubrication and stronger pieces.

**Granite Surface Plates: No. 160**

A catalog sheet with list of standard sizes and prices of Lawley black granite surface plates is available. Plates are reported to have overall accuracy up to .00005.

**Heat Treating Equipment for Aluminum: No. 161**

A new bulletin from General Electric Company, one of the first of a new Modern Metal Processing series to be released by the company is devoted to "Heat-treating Equipment for Aluminum."

## FINISHING

**Optical Gaging: No. 165**

Some of the more recent developments in the technique of using optical projection as a production tool are covered in a technical report, "Optical Gaging," issued by Eastman Kodak Co., Industrial Optical Sales Div.

**Tumble-Blasting for Metal Finishing: No. 166**

Pangborn Corp. offers a 12-pg bulletin on its new Blastmaster Rotoblast which combines tumbling with an abrasive blast specifically designed for metal finishing operations on castings, forgings & heat-treated parts. Eight special features are emphasized including a steel-mesh and rubber abrasive-tight door.

**Reference Book on Pickling: No. 167**

New edition of a copyrighted reference book, "Efficient Pickling with Rodine," is offered by American Chemical Paint Company. First published in 1924, the 80-pg book has been brought up to date with latest revisions in Sept. 1952. It is written as a text book divided into 5 parts and appendix, fully illustrated with photos charts and diagrams.

**Wear-Resistant Lathe Center Tips: No. 168**

Cast Colmonoy No. 6 wear-resistant alloy lathe center tips that can be applied to worn lathe centers or purchased integral with new centers, are described in bulletin from Diamonds and Tools, Inc.

**All Sizes & Types of Collets: No. 169**

A comprehensive catalog that lists every size & type of collet offered in the industry has been published by Sutton Tool Co., and includes in its 26 pages specs, prices, drawings and descriptions of collets, feeders and pads.

**Automatic Rack-Type Plating Equipment: No. 170**

From Frederic B. Stevens, Inc., can be obtained a new bulletin on automatic rack-type plating equipment. Heavy duty cleaning and pickling and automatic bright dipping are among jobs illustrated.

**Rubberized Abrasives: No. 171**

Treatise about use of rubberized abrasives for burring, smoothing and polishing operations is included in a new catalog from Cratex Mfg. Co. on their rubberized abrasive wheels, sticks, blocks, points, and cones.

**Eighty Ways to Test, Inspect & Analyze: No. 172**

To show industry some of the quality control methods available to them from American Standards Testing Bureau, Inc., the organization has published a folder showing 80 different methods for testing, inspecting and analyzing different types of products.

**Newer Uses for Ion Exchangers: No. 173**

The newer roles for ion exchangers in industry are emphasized in a 28-pg bulletin from The Permutit Co. Among the uses for ion exchangers are electroplating, non-ferrous metals, treatment of wastes.

continued on page 71

# when you THINK of FASTENERS think of CENTRAL...

## CENTRAL MAKES EVERY TYPE FOR ALL DIE-CASTING ASSEMBLIES!

### TYPE "1" THREAD CUTTING

Better for metal where a thread cutting action supercedes thread forming. Type "1" Central Thread Cutting Screws drive with minimum torque to form a perfectly mated thread and a tight fit. Interchangeable with standard machine screws.

### TYPE "23" THREAD CUTTING

Note the wide thread cutting slot that works better in softer metals such as aluminum and zinc, or in harder metals where the wide slot affords better cutting advantages.

### TYPE "25" THREAD CUTTING

Here the exclusive wide flute cutting slot combines with a specially spaced thread for low driving torque, high resistance to stripping and extra-free cutting action. Ideally suited to soft metals and plastics. Write for full details.

DRIVE SCREW TYPE "U"

### TYPE "A" TAPPING SCREWS

Pointed and augur-like, the Central Type "A" Tapping screw pulls and forms thinner (.015" to .050") sheets of metal into a matching threaded section from punched, drilled, or nested holes. Available with slotted, Phillips, clutch or hexagon heads.

### TYPE "B" TAPPING SCREWS

Die-pointed and augur-like for thicker metal (.050" to .200"), Central Type "B" Tapping Screws pass through a hole in one piece, form their own threads to lock both parts securely. For porous castings, non-brittle plastics, fibre and asbestos materials.

### TYPE "C" TAPPING SCREWS

Recommended for general use in metals from .030" to .100" thickness. Standard pitch thread interchangeable with standard machine screws. Ideal for chip-free assemblies. Second assemblies can be made on projected end of the screw.

"You Can Depend on Central"

**CENTRAL SCREW COMPANY**

3501 SHIELDS AVE., CHICAGO 9, ILLINOIS

3028 E. ELEVENTH ST., LOS ANGELES 23, CALIF. • 149 EMERALD ST., KEENE, N. H.

*For additional information Circle No. 31 on the Reader Service Card*

# REFERENCE MATERIAL

**Catalogs and data offered free in this month's ads; to receive copies circle number on reader service card.**

1. COLLOIDAL GRAPHITE LUBRICANTS for die casting dies are explained in reprint and special bulletin from Acheson Colloids.

2. INDUCTION MELTING furnaces for close temperature control of die casting alloys described in literature from Ajax Engineering.

3. HYDRAULIC PUMPS that reduce fire risk and cut hydraulic fluid costs in die casting machines are reported in Aldrich Pump catalog.

6. DIE CASTING MACHINE specifications are in catalog from Cleveland Automatic Machine Co.

8. DIE CASTING MACHINE catalog showing complete line of equipment is offered by Cast Master.

9. SMALL DIE CASTINGS from specialized departments of Dollin Corp. are featured in a booklet.

10. DIE CASTINGS is title of booklet from Hoover Co., Die Casting Div. describing company facilities & giving design information.

11. INVESTMENT CASTINGS—when to specify & when not to specify them — reported in 4-pg brochure from Howard Foundry.

12. DIE CASTING MACHINES from Hydraulic Press Mfg. Co. are described & illustrated in a specification catalog.

13. INVESTMENT CASTING advantages & uses are reviewed in booklet from International Nickel Co.

15. DIE CASTING MACHINES of many sizes & capacities are presented in a catalog from Kux Machine Co.

16. LATEST NEWS on die casting machines & plastic presses is contained in regular publication distributed by Lester-Phoenix.

23. BRASS DIE CASTINGS and permanent mold castings produced by Pressco Casting & Mfg. Co. are covered in data book, including of alloys & properties.

26. MANY FURNACES for melting aluminum, brass & other metals are presented along wth specs, in catalog from Stroman.

27. DATA BOOK on steel-belted pistons for all types of engines presented by Thompson Products, Light Metals Div.

29. COLD WORK DIE STEELS are subject of 24-pg data book from Vanadium Alloys Steel.

30. HOW TO SELECT and use abrasive grains and powders for finishing metals is subject of data book from Carborundum.

31. THREAD-CUTTING SCREWS developed specifically for assembling die castings are presented in literature available from Central Screw.

32. BARREL FINISHING equipment, accessories & supplies are contained in Grav-I-Flow catalog.

33. SPECIALISTS IN ALUMINUM alloy casting have issued a booklet describing their facilities. Acme Aluminum Alloys, Inc.

34. PLASTER MOLD CASTINGS produced to close tolerances reported in data book from Atlantic Casting & Engrg.

36. COST REDUCTION made possible through application of investment castings to product design is subject of a new brochure issued by Casting Engineers.

38. INVESTMENT CASTING as a method of producing many types of metal parts is reviewed in brochure from Hitchiner Mfg.

39. CUSTOM ALLOY POWDERS for alloy steel compositions are covered in technical literature offered by Metal Hydrides.

40. ALUMINUM CASTINGS with attractive Velva-Glaze finish are reported by Monarch Aluminum.

41. DIMENSIONING DIE CASTINGS is subject of a guide book from Newton-New Haven Co.

44. HOW TO PROTECT METAL surfaces by the use of Iridite finishes for zinc, aluminum & cuprous metals is explained in literature from Allied Research.

45. HOW TO STORE coated abrasives is subject of booklet offered by Armour.

46. PROTECTION OF ALUMINUM is given full technical coverage in data sheets and other literature available from American Chemical Paint Co.

47. SCREWTHREAD INSERTS for use in die cast metals are subject of data from Groov-Pin.

48. PRECISION BARREL FINISHING techniques are reported in detail by Roto-Finish.

50. DIE CASTINGS in zinc & aluminum produced by Advance Tool & Die Casting Co. are the subjects of literature.

54. CENTRIFUGAL INVESTMENT castings produced by Electronicast are reviewed in a folder on the process & its uses.

55. SMALL DIE CASTINGS — review of size, alloy & design limits in folder from Gries Reproducer.

56. ZINC ALLOY SUPPLIERS, Henning Bros. & Smith, offer a monthly house organ called the Henning Messenger.

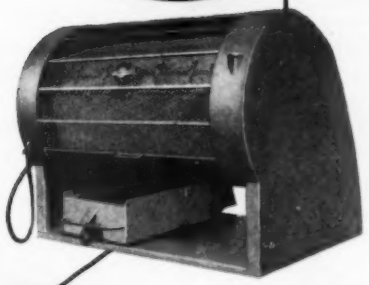
59. HOW TO DESIGN aluminum & magnesium die castings is subject of a data book from Litemetal Dicast.

continued on page 66

# Come to TUMBLE GRAV-I-FLO FINISH for ALL your tumbling needs!

You can get complete equipment and supplies for faster, better tumbling at Grav-i-Flo. This authoritative tumbling source can furnish you, from its years of experience, the correct answer to any tumbling problem.

Larger capacity machines take 31% to 80% more work-load in same floor space. Improved cutting materials shorten cutting cycle by 15% to 25%. Grav-i-Flo installations substantially reduce capital investment, floor space, and production time!



**Model 66", two compartments**

**Model 48", two compartments**

## MACHINES

Grav-i-Flo 66", 48" and 36" machines have cam locked doors with manually released safety stops; available with unlined or rubber lined cylinders, constant or variable speed drive, J.I.C. controls, and timers from 5 minute to 20 hour cycles. Equipped with electric wiring and water piping installed ready for plant hook up.

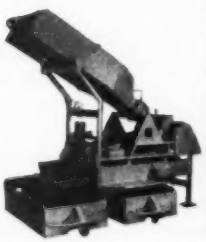
**Model 36", two compartments**

**Model 24", two compartments**

Designed For Small Lot Production and Laboratory Processing.

## ACCESSORIES

**Two deck parts-and-chips separator and chip grader**



Occupies less floor space. Separates parts quickly without impingements. Grades 3 sizes of chips simultaneously.

**Other Grav-i-Flo accessories include tubular yoke hoist pans, chip pans, wash-out doors, screens, chip bins, unloading boots, dip tanks.**

## *Chips and compounds*

Grav-i-Flo natural and synthetic deburring and finishing chips and highly developed compounds consistently outperform every type of tumbling process offered on the market.

## *Investigate!*

Grav-i-Flo superiority in equipment and supplies has been proved to hundreds of users in many different industries. Let us show you, too, at no obligation. Our representative will visit your plant, or send samples direct to us. Engineering Service available to all users.

***SEND FOR CATALOG*** showing complete line of Grav-i-Flo equipment, accessories and supplies.

**THE GRAV-I-FLO CORPORATION**

Dept. PM-3 400 Norwood Avenue
STURGIS, MICHIGAN

*For additional information Circle No. 32 on the Reader Service Card*

AMERICAN CHEMICAL PAINT COMPANY
AMBLER ACP PENNA.

# Technical Service Data Sheet
# Subject: PROTECTING ALUMINUM WITH ALODINE®

## "ALODINE" No. 100

"Alodine" No. 100 forms an amorphous phosphate surface on aluminum which is thin, tough, durable, non-metallic, continuous with and a part of the basis metal. The "Alodine" film anchors paint, prolongs paint life, and protects aluminum exposed unpainted to the atmosphere.

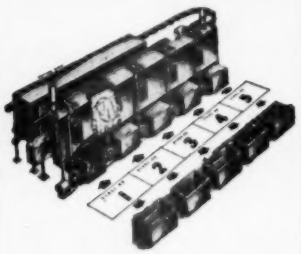
With the "Alodine" No. 100 bath at its normal temperature of 120° F., coating time by immersion approximates 1½ minutes—and by spraying, 15 to 20 seconds. Coating times and bath temperatures can be varied to suit operating conditions.

## "ALODINE" No. 600

"Alodine" No. 600 forms corrosion-resistant coatings that provide excellent protection for unpainted aluminum and also make an effective paint-base. This grade is recommended for use in place of "Alodine" No. 100 on aluminum parts that are to remain unpainted or to be only partly painted; and on *all* aluminum castings and forgings whether or not these are given a paint finish.

## "ALODINE" FLOW SHEETS

**MULTI-STAGE POWER WASHER FOR SPRAY ALODIZING**



**IMMERSION TANKS FOR DIP ALODIZING**

**PROCESS SEQUENCE**

1. Clean 2. Rinse 3. "Alodine"
4. Rinse 5. Final Rinse

**NOTE:** Equipment can be of mild steel throughout, except the "Alodine" stage which must be of acid-resistant material.

"Alodine" No. 600 is applied at room temperature (70° to 120° F.). Recommended coating times are 3 to 5 minutes for an immersion process and 1 to 1½ minutes for a spray process.

| COATING DATA | "ALODINE" NO. 100 | "ALODINE" NO. 600 |
|---|---|---|
| COMPOSITION | Amorphous phosphate. | Amorphous mixture of metal oxides and chromates. |
| COLOR | Depending on alloy treated, color range is from an iridescent blue-green to a dark slate gray. | Depending on time of treatment, color range is from golden iridescent to light brown. |
| THICKNESS | From 0.01 to 0.08 mil. No appreciable dimensional changes occur when aluminum is Alodized. | From 0.005 to 0.01 mil. No appreciable dimensional changes occur when aluminum is Alodized. |
| WEIGHT | 50 to 300 mgs. per square foot. Optimum: 100 to 200 mgs. per square foot. | 35 to 50 mgs. per square foot. |
| SOLUBILITY | Insoluble in water, alcohol, solvents, etc. Insoluble in most dilute acids and alkalis. However, strong acids and alkalis which attack aluminum may penetrate the "Alodine" film and react with the underlying metal. Slightly soluble in concentrated nitric acid. Soluble in molten sodium nitrate, etc. | Insoluble in alcohol, water, solvents, etc. Soluble in strong alkalis and acids. |
| ELECTRICAL PROPERTIES | High dielectrical resistance. | This coating is electrically conductive. Aluminum coated with "Alodine" No. 600 can be shielded-arc welded or spot welded. |
| HEAT STABILITY | Unimpaired at temperatures that melt aluminum. | Unimpaired at temperatures that melt aluminum. |
| FLEXIBILITY | Integral with and as flexible as the aluminum itself. Can withstand moderate draws. | Integral with and as flexible as the aluminum itself. Can withstand moderate draws. |
| ABRASION RESISTANCE | Approximately 90% of that provided by chromic acid anodized aluminum. | Approximately 90% of that provided by chromic acid anodized aluminum. |
| CORROSION RESISTANCE | Painted—superior to chromic acid anodizing. Unpainted—comparable with chromic acid anodizing. Meets MIL-C-5541 and other Government Finish Specifications. | Exceeds requirements of MIL-C-5541 and even AN-QQ-A-696a (anodic films) |
| PAINT-BONDING | Excellent. Equal to or superior to anodizing. Meets MIL-C-5541 and other Government Finish Specifications. | Excellent. Meets MIL-C-5541 and other Government Finish Specifications. |
| TOXICITY | Non-toxic. | Non-toxic. |
| BIMETALLIC CORROSION RESISTANCE | Shows good resistance against bimetallic or galvanic corrosion. | Shows good resistance against bimetallic or galvanic corrosion. |

CHEMICALS ACP PROCESSES

**WRITE FOR FURTHER INFORMATION ON "ALODINE" AND ON YOUR OWN ALUMINUM PROTECTION PROBLEMS.**

CHEMICALS ACP PROCESSES

*For additional information Circle No. 46 on the Reader Service Card*

REFERENCE MATERIAL — cont.

60. SPECIALTY STEELS for die casting dies are introduced in literature from A. Milne & Co. covering steels for trim dies, shot cylinders & closing cylinders.

61. DIE CASTING FACILITIES of Paramount Die Casting are presented in a brochure.

65. "GOOD THINGS TO KNOW about metal cleaning" is title of booklet available from Oakite.

67. MACHINES for producing small die castings are presented in folder from A. B. C. Die Casting Machine Co.

69. ALLOYS FOR INVESTMENT casting are described in literature from Cannon-Muskegon.

79. LONGER LIFE FOR DIES is reported in bulletin from Pangborn Corp. describing process for wet blasting die casting dies.

81. ENGINEERING BULLETIN on investment castings is offered by The Adapti Co.

84. REFERENCE FOLDER on line of P-V investments for investment casting is offered by Pre-Vest.

85. THREAD CUTTING screws with pre-assembled lock washers designed for use with die castings are reviewed in literature from Eaton Reliance Div.

86. DEBURRING OF HOLES by means of new type tool is subject of folder from NoBur.

87. MULTIPURPOSE GRINDER-MILLER is described in illustrated literature from Precise Products. Unit is mounted on drill press, etc. for tool or production work.

89. SAMPLES OF COPPER POWDER are available from Malone Metal Powders who make dendritic copper powder.

91. SMALL TOOLS for die work, and a regrinding service for keeping tools in good cutting condition, are presented in a catalog from Severance Tool Industries.

93. BARREL FINISHING is discussed in a set of 3 booklets from Almco Div., Queen Stove Works.

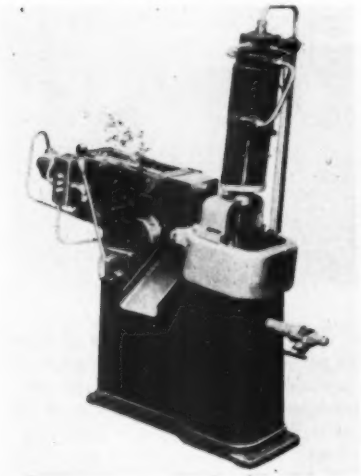
# NEW PRODUCTS

**For additional information on these products circle key number on reader service card bound in this issue.**

## HIGH SPEED, HIGH PRESSURE IN 1-LB ZINC DIE CASTING MACHINE

*IMP/96*

*DCMT Sales Corp.*



SPECIAL FEATURES: High speed, high pressure injection are features of new 1-lb. zinc die casting machine. Injection system is impact type where piston area for injection is higher than area for return, resulting in high speed injection with no cushioning effect from air trapped beneath piston.

SPECIFICATIONS: Main valve is pilot operated type so that no throttling effect is undergone by air entering injection cylinder. Fast chilling, high cycling, automatic ejection of castings are features. Producton runs of 800 to 1000 shots per hour obtained.

Small, pre-fabricated die blocks are competely machined except for cavity, allowing use of single cavity die with lowered die costs.

Unit weighs 470 lbs.; occupies 12" x 36" floor space. Complete engineering counselling service and cost analysis available on any part which can be die cast on this machine. Service is free in addition to regular die design service whereby purchaser of machine is given a die design free of charge.

***For additional information Circle No. 196 on Reader Service Card***

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## WATER-TYPE COOLANT CONTAINS WAX

*No. 130 Wax-Cool*

*S. C. Johnson & Son, Inc.*

SPECIAL FEATURES: Water-type coolant that contains wax is intended for use in metal working machines that use water-soluble coolants. Exceptional lubricating qualities and minimum heat are reported.

SPECIFICATIONS: Wax-fortified water emulsion is sold as a concentrate to be mixed with 20 parts of water before use. Packaged in 30- and 55-gallon drums.

***For additional information Circle No. 197 on Reader Service Card***

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## 8-COMPARTMENT PORTABLE OVEN FOR DRYING, BAKING

*Model PL 2A*

*Grieve-Hendry Co., Inc.*

SPECIAL FEATURES: Portable electric oven with 8 compartments permits drying, baking or preheating different sizes or types of products simultaneously.

SPECIFICATIONS: Operating cost said to be less than 5c per hr.; adjustable temperature control to 325 F; operates from 110V AC outlet; oven size 30" wide x 25" deep x 24" high.

***For additional information Circle No. 198 on Reader Service Card***

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## 4-IN-1 FOUNDRY PACKAGE OF SHELL MOLDING SYNTHETICS

*Chemical Division of General Electric Co.*

SPECIAL FEATURES: New 4-in-1 "foundry package" of all synthetic materials required for shell molding process and for traditional sand casting.

SPECIFICATIONS: Contains 2 materials for shell molding: S-1054 phenolic resin binder, and SM-55 silicone parting agent to release shells from metal patterns. Also contains G-E 12353 liquid core binder resin and G-E 3255 Permafil for impregnating porous castings.

Resin binder is said to give denser packing, particularly in deep draws, slots, holes; give castings with less burn-in and less gas porosity.

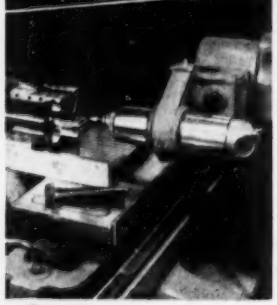
Silicone parting agent has no fire hazard, leaves negligible residue on patterns and has improved release properties.

Core binder permits baking in half the time & at

continued next page

*For additional information Circle No. 87 on the Reader Service Card*

LOWEST COST PRECISION
FOR TOOL ROOM AND PRODUCTION



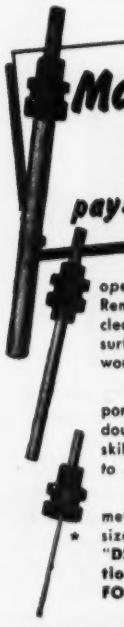
ONE PORTABLE MULTI-PURPOSE PRECISE GRINDER-MILLER WITH MACHINE TOOL MOUNT DOES THE WORK OF A SINGLE-PURPOSE MACHINE COSTING 100 TIMES AS MUCH!

Little can be done today to reduce labor and material costs. For substantial savings employ new, better techniques. Mount PRECISE Grinder-Millers on lathes, drill presses, milling machines and other machine tools or use in special production set-ups. ¼ HP; speeds from 20,000 to 45,000 r.p.m.; 115 volts, AC-DC. Ruggedly built for continuous duty. All metal housing; rigid PRECISE quill; sealed micro-precision bearings. *High speeds and accurate PRECISE quill and chuck are ideal for tungsten carbide cutters.* PRECISE will grind, mill or finish any material from soft wood to the hardest alloy steel.

*Write* FOR NEW CATALOG

PRECISE PRODUCTS CORP., 1342 Clark St., Racine, Wis.

*Precise* GRINDER-MILLERS



*Machine de-burring*
*with* NOBUR
*pays BIG production dividends!*

**NOBUR Tools** *turn a slow bench operation into fast and efficient machine work!* Remove burrs on multi-walled parts with a smooth, clean cutting action that won't mar highly finished surfaces. Eliminate rejects from slow, costly hand work with files, scrapers and abrasives.

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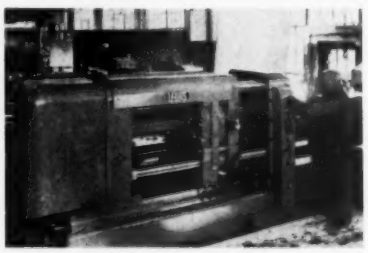
## RAPID FILL, HIGH INJECTION PRESSURE IN COLD-CHAMBER MACHINE

*Die Forge Casting Machine*
*Lewis Welding & Engineering Corp.*



SPECIAL FEATURES: New principle of injection provides rapid fill while metal is molten, and 100,000 psi injection pressure accomplsihed by special hydraulic 2-stage injection system. New method of die locking is known as Hydra-Lock, which develops final clamping pressure of 650 tons. Prevention of shrinkage voids & excessive porosity from trapped gases is reported.

SPECIFICATIONS: Clamping mechanism uses small hydraulic cylinder to advance platen to position where die faces are fraction of an inch apart; 28" diam. cylinder actuated automatically closes dies and applies locking pressure; mechanical locking device holds platen in closed position. Stroke of large cylinder is so short that only fraction of a gallon of oil & few tenths of a second are required to close.

Injection is accomplished by 2 concentric pistons. Small diam. piston travels 810 fpm to fill die cavity; when die is filled, large diam. piston is activated. Total pressure of 100,000 psi is developed with 2100 psi in hydraulic system.

Unit weighs 29,100 lbs. Bed, frame & platens fabricated from heavy rolled steel plate for strength with minimum weight. Design of clamping system is said to make die setup easier. High safety factors employed. Hydraulic unit furnished separately to make installation as convenient as possible & reduce overall length of machine.

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## FINGER-TYPE SISAL BUFF

*20-RD Sisal Buff*
*George R. Churchill Co., Inc.*

SPECIAL FEATURES: Each finger of buff is extremely flexible, making buff adaptable for work involving

continued next page

curved surfaces and recesses. Special manufacturing process permits buff to pick up & hold cutting compounds readily.

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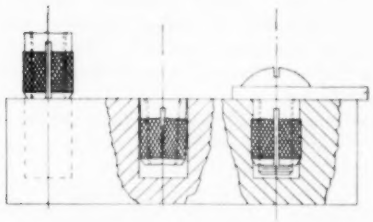
## KNURLED SCREW-THREAD INSERTS FOR CASTINGS

*Screw Locking Inserts*
*Brush Nail Expansion Bolt Co.*



SPECIAL FEATURES: Provides threads in blind holes, such as cored holes in die castings, plastics, etc. Knurling provides high resistance to torque.

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continued next page


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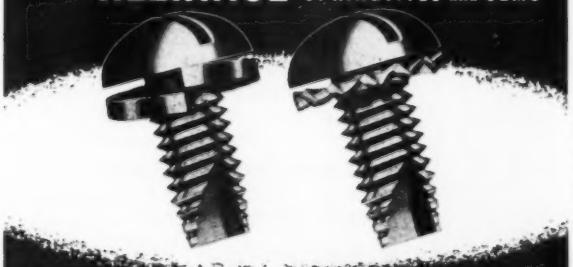

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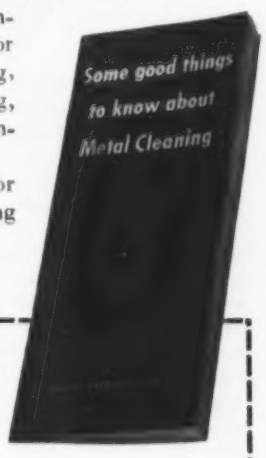


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driven, it forces sides of knurled inserts into positive contact with walls of hole.

Standard knurled inserts made of aluminum, but are available in other materials and in sizes to accept screws from 4-40 to 1/4-20.

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## EXPAND POWDER METALLURGY PLANT

American Brake Shoe Company is expanding its facilities for the manufacture of powder metallurgy products. As part of its diversification program, the company entered the field after four years of laboratory research. The first products to be marketed were friction materials for clutch parts. Other applications are in progress in the research laboratories and in field tests.

Production facilites were installed in the company's Hillburn, New York plant and the expansion will double present capacity. The plant is operated as a unit of the American Brakeblok Division which makes brake lining and laminated plastic bearing materials.

MAGNETIC HOUSING
continued from page 36

illustration it is at once apparent that a casting method is the only economically feasible process of manufacture. While the part could be hogged out of bar stock, the scrap losses would be intolerable. Again, because of the accuracy requirements, sand casting cannot be used since a very great amount of finish machining would be required. Further, in trying to cast thin walls so as to avoid large machining losses, the number of rejected castings due to imperfections would be high.

Eliminating sand casting as a possible method of production leaves only die casting or investment casting as economically feasible methods. In this case, die casting is at once eliminated because of the relatively small number of pieces needed so that investment casting is left as the only economical method of manufacture.

Choice of metal still lies, however, between a brass, bronze or aluminum. From the point of view of weight and cost, aluminum was chosen for the part.

**Foundry considerations:** Normal foundry tolerances of ± 0.005 per inch are adequate and all but two of the necessary holes are larger than required for a No. 6 machine screw so that they can be cored easily. The really critical points on the housing are the diameters and concentricities of the upper suspension bore, the mounting for the iron core, and the bore for the lower suspension. Required tolerances in these three places are so close that a machining operation would be required regardless of the method of manufacture, always assuming a casting procedure.

The position and angularity of the opening in which the moving coil operates are critical dimensions, but ones readily held by the foundry.

36½" die casting in one piece with Cast Teeth!

produced by

PARAMOUNT

- Material: #3 Zinc Alloy
- Length: 36½"
- Weight: 2.2 lbs.
- Gear Rack: 279 teeth, 24 pitch
- Calibrations: By 1/16ths

A little out of the ordinary? Yes. But this casting demonstrates what can be done when engineering know-how, die-making skill and die casting techniques are teamed. The result: substantial savings for the customer in material and machining costs!

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ALUMINUM & ZINC DIE CASTINGS

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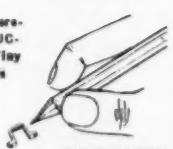

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SALES REPRESENTATIVE: covering Ohio desires die casting account. Write Box 3453, Precision Metal Molding magazine.

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## PROGRAM OF CHEMISTRY OFFERED

A new program intended primarily to assist and advance the teaching of chemistry in American colleges and universities will be begun by the Du Pont Company next fall, it has been announced. Thirty-two institutions will receive new fellowships or grants for the next academic year as the result of a comprehensive survey by the company that revealed the need for such assistance.

In one plan under this program, grants have been made to 19 four-year private colleges to help them maintain their outstanding performance in the training of students majoring in chemistry. In the other, the company has awarded post-graduate fellowships to 13 universities to improve the teaching of chemistry to undergraduates.

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CHROMIUM-NICKEL ALLOY
continued from page 45

under like conditions. For the 80% chromium — 20% nickel and 50% chromium — 50% nickel alloy powder additions, increase in alloy content produced appreciable increase in tensile strengths; with the 20-80 additions, the effect of increase in alloy content on tensile strength values was not appreciable. Hardness increased and elongation decreased with increase in alloy content for all three alloy combinations.

The effect of sintering conditions of temperature and time on the properties of electrolytic iron powder containing 10 percent alloy powder of the three given compositions was studied. Test results obtained for sintering temperatures of 1100C (2012F) and 1200C (2192F) and times of one and two hours are given in Table 4.

Increase in sintering time produced increased strength in the powder compacts containing 80% chromium — 20% nickel and 50% chromium — 50% nickel. Increase in sintering temperature produced an increase in strength with the 50% chromium — 50% nickel only. (This result may again be attributed, at least in part, to the closeness of this alloy composition to the eutectic.)

Increase in sintering temperature and time produced no appreciable effect on the compositions containing 20% chromium — 80% nickel alloy. No definite trends in hardness or elongation values were observed.

To further evaluate these materials, 1% graphite[4] was added to the electrolytic iron powder and tested in combin-

continued next page

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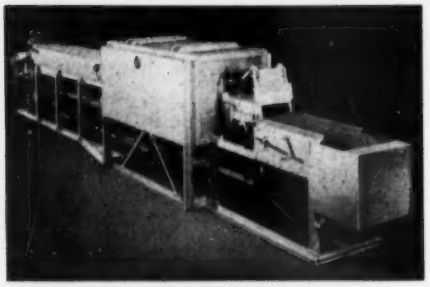

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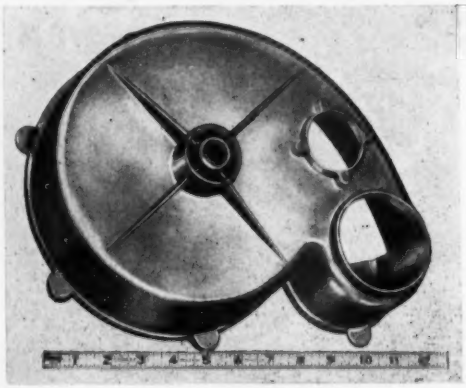

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ation with 10% alloy additions of the three chromium-nickel alloy powders under examination. It was recognized that the presence of carbon in a chromium-nickel-iron composition would no longer leave the material in the classification of conventional stainless steels. Nevertheless, it was felt well worth while to ascertain what improvement in properties could be secured with this graphite addition. Test results are given in Table 4.

An appreciable increase in tensile strength (from 66,100 to 95,300 psi) for the composition containing the 80% chromium — 20% nickel alloy was secured by increasing the sintering time from one to two hours while holding the temperature constant at 1100C (2012F). Relatively the same increase was secured by increasing the sintering temperature from 1100C (2012F) to 1200C (2192F) holding the time constant at one hour. Hardness and elongation values remained substantially constant for all conditions of treatment.

Increase in either sintering temperature or time produced an appreciable increase in tensile strength of the powder composition containing the 50% chromium — 50% nickel alloy powder, with the temperature increase showing slightly more effect. The effect of combined increase in sintering temperature and time produced a cumulative effect on this material. The tensile strength for the sintering condition of two hours at 1200C (2192F) (121,000 psi) was double that for one hour at 1100C (2012F) (60,300 psi).

Increase in sintering temperature and time affected the tensile strength of the composition containing 20% chromium — 80% nickel alloy powder to a much lesser extent, wth the maximum increase on the order of 15 percent.

In general, for comparable conditions, the addition of 1 percent graphite produces an appreciable increase in tensile strength and hardness over the compositions containing no graphite.

Heat treatments were applied to compacts of electrolytic iron — 1 percent graphite with 10 % contained chromium nickel alloy powders of the three compositions under study to determine the effect of these heat treatments on the properties of the respective compositions. Tensile strength, elongation, and hardness values, together with conditions of heat treatment are shown in Table 5.

Optimum tensile strength was secured on the specimens as coined, quenched, and annealed. An increase in tensile strength of approximately 50 percent over specimens as sintered was obtained with comparable increases in hardness. No appreciable change in elongation values was observed

While only one type of heat treatment has been used to date, the use of this approach as a means of increasing tensile strength offers considerable promise and merits additional investigation.

## Conclusions

The current investigation is only the initial research phase in determining the position of chromium-nickel alloys in the powder metallurgy field and their applicability in combination with iron and graphite powders to produce alloy steel compositions. Considerable development will necessarily have to be made on the possible effect of additives to these alloys (i.e. manganese, silicon, etc.), the exact conditions of sintering to be used, and the heat treatments to be applied subsequent to sintering to produce optimum properties under each condition.

The chromium-nickel alloy powders offer considerable promise in applications where highest possible strength is required. Another factor of practical merit is the ability to secure good physical properties from blends of these alloys with iron and graphite powders by the simple processing steps of compacting and sintering. More complex handling procedures are now being used in an appreciable portion of conventional powder metallurgy. The additional cost of the alloy powders may be less than the costs of these additional operations.

Further research on the properties of chromium-nickel alloy powders in the development of stainless steel compositions, together with studies of other alloy powders produced by the Hydride process is in progress. This data is to be made a subject of subsequent papers.

## Acknowledgement

This paper is the result of work sponsored by Metal Hy-

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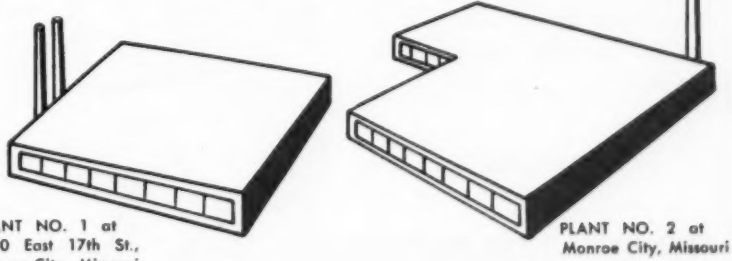

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CHROMIUM-NICKEL — cont.

drides Inc., 12 Congress Street, Beverly, Mass. at the laboratories of S-K-C Research Associates, 445 Fifth Ave., Paterson, N. J. Continuing work on these and other alloys will be reported on as the project progresses.

(1) The three alloys studied in the current investigation were selected arbitrarily for test. The Hydride process can be used for the preparation of many other alloy powders of wide range and composition.

(2) Alexander, P. P.. — U.S. Patent No. 2,287,771

(3) National Radiator Company — Plast-Iron — 100 mesh electrolytic iron powder. (This powder was hydrogen reduced at 500 C (932 F) for ½ hour prior to use.)

(4) Joseph Dixon Crucible Company Graphite No. 8485.

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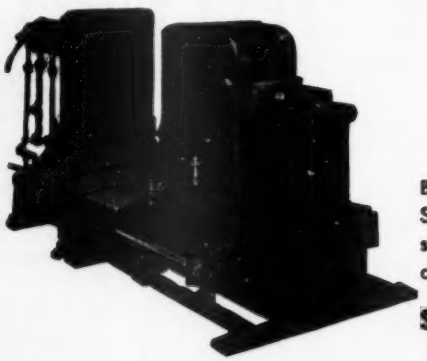

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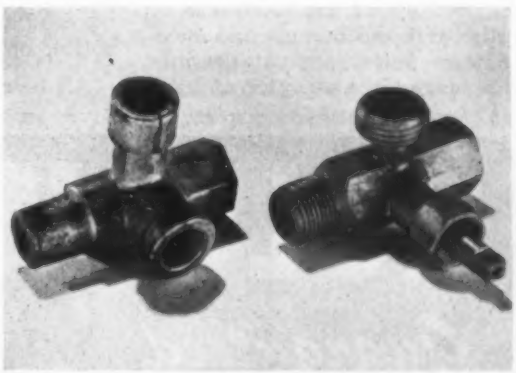
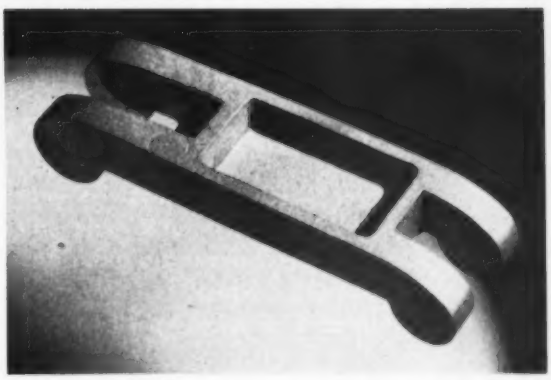
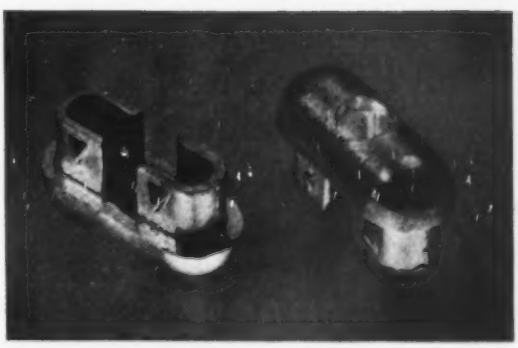
BRASS — Brass has been a traditional material for plumbing fittings, but new fabricating methods are now replacing some of the old, inefficient techniques. Here, an assembly of pieces turned from bar and tube stock has been replaced with a brass die casting. In place of the brazed assembly of pieces, shown at right, a one-piece die casting produced by Pressco Casting & Mfg. Corp., Chesterton, Indiana, is displayed at the left. Its unitary construction accurately cored holes and lower finished cost are important advantages.



STAINLESS STEEL — Stainless steel has an essential place in the construction of aircraft. One of the best methods of forming this difficult material when tolerances are close is investment casting. The piece at the right is a lever plunger casting for a jet engine fuel injector. It is supplied in stainless type 416 heat treated by Crucible Steel Company of America from their Harrison, N. J. works. All expensive machining operations which would be needed to form this from a sand casting, forging or bar stock have been eliminated. Tolerances specified are ± .010 on dimensions up 1", with ±.015 up to 2" and ± .020 up to 4".



ZINC — Zinc in its die cast form is so widely used that it is difficult to find a field of manufacturing which does not employ it. Even in the industries which manufacture products that are primarily non-metallic, die cast zinc often is used. These include the textile, wood-working, paper and other industries. A good example is this small plated zinc die casting used on post binders. These little end-closures cost about half the price of stampings, are strong, non-rusting and have built in triangular bosses to act as grippers. They are produced for Loose-Leaf Metals Co. of St. Louis, Mo., by Clyde Equipment Co. of St. Louis.

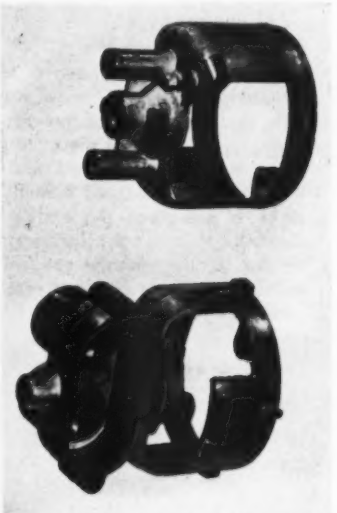


STABILITY & STRENGTH
continued from page 46

what exceptional and serve to further illustrate the versatility of the die casting process and its men.

Because of the small size of the unit and because the maximum power out-put possible is desired, the precision of manufacture required is, perhaps, considerably greater than is normal for small motor manufacture. To secure the desired characteristics in the motor, the air gap between the rotor and stator must be small and uniform; this accounts for the ± 0.002 spherical tolerance on the bearing seat and the concentricity tolerance between the seat and the bore of the bell of only 0.006 TIR.

All holes needed for mounting components and even srcew holes are held closely, as can be seen from Figure 2. Holes as small as 0.071 diameter are held to ± 0.002 while their location with respect to the center line or some other indexing point is equally close.



**3. CLOSER ACCURACY than is usual for small motors is required of these die cast end bells.**

The cost of such casting accuracy is, of course, considerably higher than if more open tolerances were allowed. This increased cost must be balanced against the cost of machine work after the casting is received. In this case, the accuracy of casting is justified by the lower cost as compared with a rougher casting that must be machined.

Because of the accuracy that is possible with a zinc die casting, there is little if any machining to be done so that the units can be assembled in the as-received condition.

**MERGER APPROVED**

Directors of American Smelting & Refining Company have approved a merger of Federal Mining & Smelting Co., a 55% owned subsidiary, into American Smelting & Refining Co., and directors of Federal have taken similar action. The merger is subject to approval by stockholders of both companies, meetings of which are scheduled for April.

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# INDUSTRY NEWS

### NATIONAL LEAD BUYS DOEHLER-JARVIS CORP.

The sale of assets of Doehler-Jarvis Corp. to National Lead Co., for National Lead Co., common stock and the dissolution of Doehler-Jarvis Corp. has been approved at a special meeting of Doehler-Jarvis shareholders, it is announced by F. J. Koegler, president of the corporation.

Upon the dissolution of Doehler-Jarvis, Corp. its shareholders will receive 1.15 shares of National Lead common stock for each share of stock of Doehler-Jarvis. As part of the transaction National Lead Co. will assume all the debts and liabilities of the corporation, which will be operated as a unit of National Lead.

National Lead, aside from being an important producer of paint, pigments, lead products, and antimony, is also active in the titanium industry. This acquisition expands National Lead's metal fabricating divisions and give it large die casting facilities.

Doehler-Jarvis Corp., was formed on December 30, 1944 by the consolidation of Doehler Die Casting Co. and the W. B. Jarvis Co. of Grand Rapids. The Doehler Die Casting Co. was founded in 1908 by H. H. Doehler, in Brooklyn, New York, and under his leadership as chief executive of the firm for 45 years grew from a one machine beginning to a huge industrial concern which at the time of the sale to National Lead Company is operating nine die casting and finishing plants in five states and employs approximately 8500.

---

### POWDERED METAL PRODUCTS EXPANDS CAPACITY 40%

Powdered Metal Products Corporation of America, 9335 W. Belmont Ave., Franklin Park, Ill., has announced the beginning of construction work on a new plant addition at the company's Franklin Park location to expand facilities by 40 percent. The firm fabricates powdered metal gears, bearings and other component parts and pioneered recently in the development of production facilities in connection with the new shell molding process for precision casting.

The new plant addition will be a large quonset type structure 6000 square feet in area. It will house new furnaces and will contribute mainly to an increase in the company's output of powdered metal parts.

---

### KENNETH M. GLESZER NEW V. P. OF DIXON SINTALOY

Kenneth M. Gleszer has recently been appointed vice president and general manager of Dixon Sintaloy, Inc., a wholly-owned subsidiary of Joseph Dixon Crucible Co. The

Kenneth M. Gleszer

powder metallurgy firm is located in Stamford, Conn.

Mr. Gleszer was formerly a process engineer at Moraine Products Div. of General Motors Corp., and after serving as communication officer for the Maritime Service during the war, he joined the Micro-Ferrocart Division of McGuire Industries as research and development engineer in powder metallurgy. He was later chief engineer and acting plant manager of American Sintered Alloys, Inc.

---

## KWIKSET INTRODUCES NEW COLOR FILM EXPLAINING POWDER METALLURGY FEATURES

As part of an expanding program designed to make the advantages of powder metallurgy better known, Kwikset Locks, Inc., through its Powder Metallurgy Division, has released a new educational color movie.

The 16mm sound film which has a running time of 16 minutes, is available for free showing to interested groups; it is especially planned for the benefit of manufacturers, engineers, purchasing agents and production men who require high volume products at low cost.

Kwikset, which has contract facilities for producing parts from metal powders, has included the following subject matter in various scenes of the film:

- **Detailed description of the manufacture of sinterings from metal powders — from design through the completed part.**
- **Story of a small brush holder showing former method and powder metallurgy method of manufacture.**
- **Scenes showing copper impregnation, porosity of an oil-impregnated cam, and various other parts made from powdered metals.**
- **Advantages of sinterings, including: cost savings, elimination of secondary operations, high production, controlled porosity, low scrap loss.**

The film is available free upon request addressed to Powder Metallurgy Div., Kwikset Locks, Inc. 516 East Santa Ana, Anaheim, Cal.

### T. L. ROBINSON HEADS NEW SOUTHERN POWDER MET PLANT

What is reported as the first plant in the South for the manufacture of parts from metal powders is being established in Spartanburg, S. C. by a group headed by T. L. Robinson.

The concern will be called Powdercraft Corporation and will have Mr. Robinson as president; G. B. Smith, vice president manufacturing; Frank Kacsandy, vice president engineering; and R. E. Watling, chief engineer.

The Powdercraft plant will be set up initially in a 10,000 square foot building to be erected on Hayne St. in Spartanburg. The company will, in addition to producing bearings and structural parts for other industries, will also pioneer new uses for sinterings for the textile industry.

Mr. Robinson is one of the pioneers of the powder metallurgy industry, having served as chief engineer and assistant

T. L. Robinson

to the president of Amplex Division of Chrysler Corp., and from 1945 to 1952, as president of Wel-Met Co., Kent, Ohio.

Employment at the plant is expected to reach about 120 persons. Limited production is expected in about three months.

### ADVANCE PRESSURE PROMOTES TWO

Two promotions in the top executive group at Advance Pressure Castings, Inc., Brooklyn, N. Y., have been announced by Alfred E. Schneier, Sr., president.

The new post of vice president and general manager has been created for Alfred E. Schneier, Jr., who formerly served as assistant sales manager of the firm which makes non-ferrous die castings. Joseph Golucci, formerly treasurer, has been named secretary-treasurer.

LARGE SINTERINGS
continued from page 35

simple sizing or burnishing operation. Similarly a finish cut may be employed on the O. D. if dead true concentricity is required, though, as stated, normal machining tolerances are frequently acceptable.

Another question frequently raised is that of the density obtainable, and the uniformity of same. These factors offer no problem since they are dependent on proper equipment,

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tooling, and the necessary overall "Know-How."

Bearing surfaces, that is self-lubricating, oil cushioned uniform porosity are readily obtainable.

Similarly, if the part is of ferrous base, or 100 percent ferrous, and a specified hardness is required, for example, equal to that of high carbon steel, that property, too, is readily obtainable.

Further, if special properties are required such as a coefficient of friction, anti-corrosion, high temperature resistance, permeability, etc., these too, are readily available through powder metallurgy.

Regarding the size for small quantity requirements, we have made units weighing 233 pounds per piece and have quoted on other units weighing as much as 700 pounds. Every proposed part must be standard, and that can be done quickly.

In our plant we have presses with greater than 2,200 ton capacity. We are constantly adding equipment, and our philosophy is this. Size alone is no deterent. Finally, the cost of large units is generally comparable and frequently provides advantages technically, mechanically, or otherwise unobtainable.


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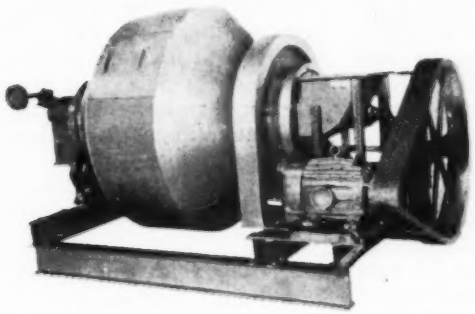

Its mixing principle is one of tumbling . . . turning . . . folding . . . cutting . . . dividing . . . stirring! With this Rotary Batch Mixer, you can get an extremely thorough blending of dry free flowing ingredients in the shortest possible time — with a minimum of power . Available in small or large capacity.

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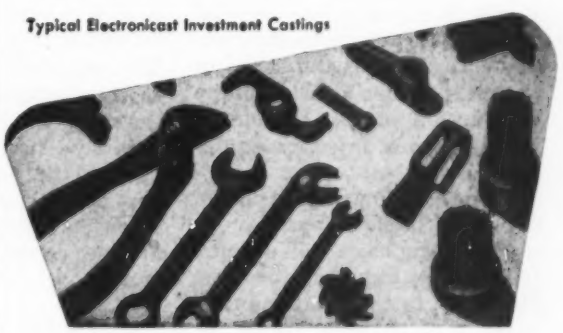

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# Pattern Dies for INVESTMENT CASTING

By
S. LIPSON*
and
H. ROSENTHAL*

**Part One**

THE first step in the investment casting process is the production of wax patterns. The die in which the wax patterns are injected represents the principal tooling cost of making a given part. For this reason, the importance of die design on the economics of the process is self-evident. Die design must take into account the volume of production expected as well as the shape of the part under consideration. The design is also influenced by the type of injection equipment available.

In production of parts from non-machinable alloys, investment casting has a well defined place as an industrial process. However, in the production of parts in machinable alloys, investment casting is in a highly competitive field. In order to compete with machining, forging, and die casting, it is often necessary to exploit its low tooling costs, which are of great importance for small quantity production.

It is evident that the die designer is usually confronted with the problem of making compromises to balance the cost of the die against the rate at which it can be amortized. The smaller the number of castings desired, the greater is the problem of producing a die both low in cost yet able to furnish the patterns. This report presents a summary of the experience gained in this field at the Pitman-Dunn Laboratory.

*Metallurgist, Pitman Dunn Laboratories, Frankford Arsenal, Philadelphia, Pa.

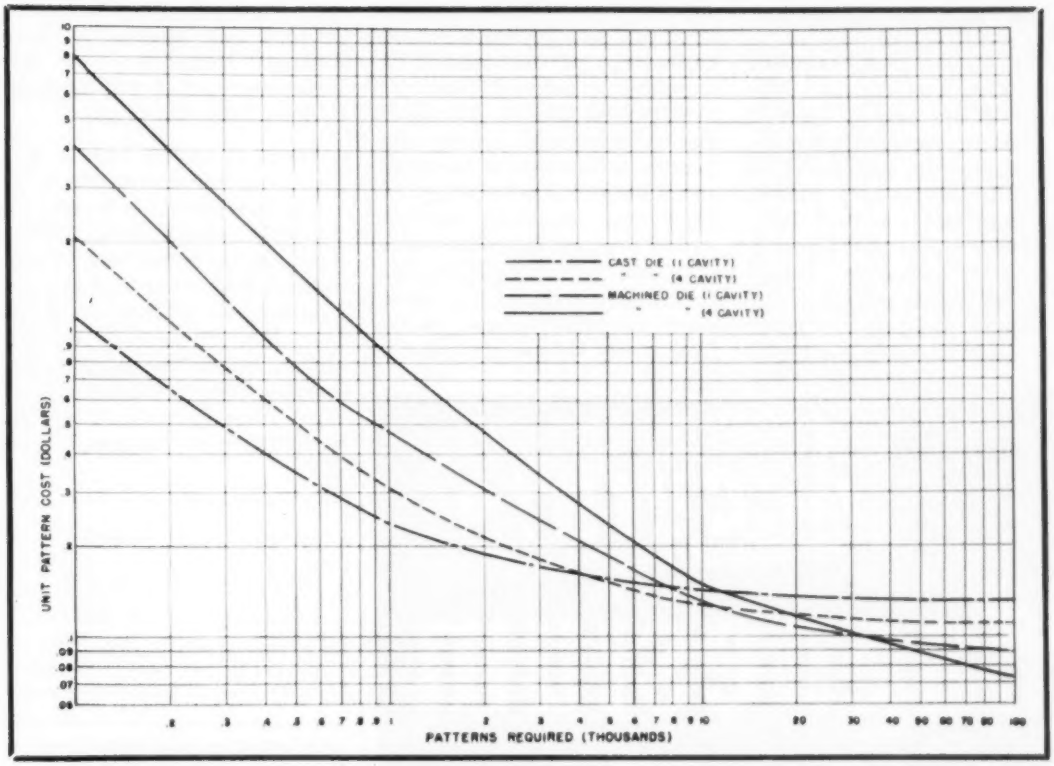
## Pattern die types

**Cast Dies** — Fusible alloy dies are produced by casting a fusible alloy against a master pattern. The parting plane is established by blocking out half of the pattern with plaster and casting each part separately. The master pattern is machined oversize to compensate for shrinkage occurring in the production cycle. Although they are not considered separately, the following factors determine the shrinkage allowance:

a. Die expansion (if any)
b. Pattern shrinkage
c. Investment mold expansion
d. Metal shrinkage

A wide selection of fusible alloys is available for producing the cast dies. The alloys vary in their casting properties, thermal expansion properties and their mechanical properties.

Dies of this type represent the most economical die type and are generally used for short run production. The dimensional stability of these



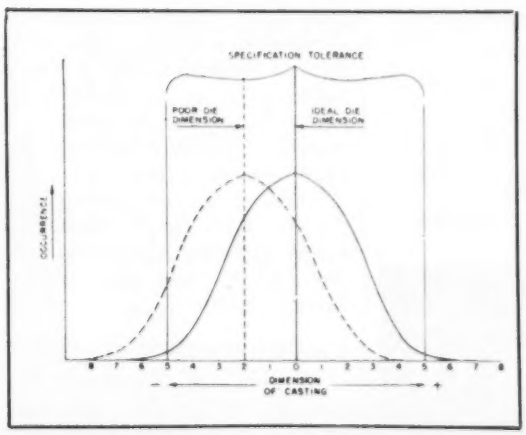

**1.** Variation of unit pattern cost with total number of patterns required is illustrated in this chart.

dies can be increased, if the die is fixed within a shell of brass, steel or aluminum. The die is cast directly into the shell. The shell greatly extends the useful life of the die and permits utilization of higher injection pressures.

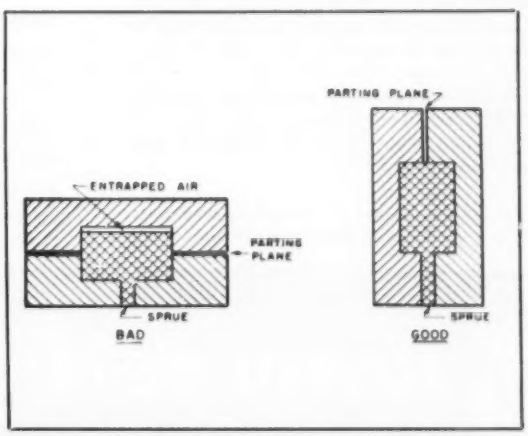
Zinc alloy dies are made in the same manner as the fusible alloy dies, except that the higher melting point of the alloy requires that careful attention be paid to achieve complete dehydration of the plaster blocking out material. These dies are much stronger than the fusible alloy type and are used without a hard shell.

By substituting wax for the fusible alloy, it is possible to produce a wax replica of the

continued next page




**2.** Effect of die dimension on the occurrence of reject castings.

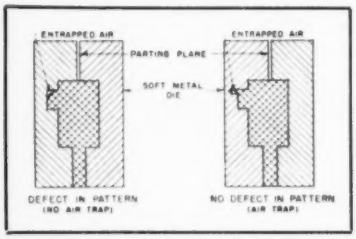



**3.** Good and bad practice in locating sprues in soft metal dies.

die by the techniques described above. This wax die can then be reproduced in any desired material by means of the investment casting process. This method is particularly useful, if the expendable pattern is to be molded of plastic. The same die making technique is also useful for producing dies for the plastic molding industry. The disadvantage is that double shrinkage is encountered and as a consequence the attainment of the desired dimensions is more difficult.

**Machined Dies** — Machined dies used for wax pattern production differ from other types of molding dies in that they require only moderate strength which permits simplified construction. The simplified construction refers to the possibility of building up the die from many simple components which are assembled by means of pins and screws. A more detailed description of this type construction will be given under a later heading.

**Multiple Cavity Dies** — For maximum productivity it is sometimes desirable to produce multiple cavity dies. These dies may be either cast or machined. Several techniques are available for production of the cast dies. These will be discussed under the appropriate heading. The principal advantage of the multiple cavity die, in addition to increased productivity, is that spruing time is greatly reduced. The components are molded in clusters which can be treed as groups of patterns. Single cavity dies require the individual assembly of the patterns to form the pattern clusters.




**4. Method for correcting unfilled areas due to entrapped air.**

**Sprayed Dies** — This die type is produced in the same manner as the cast dies, except that a metal shell in contact with the master pattern is built up by the metal spraying technique. Once a sufficient thickness is built up, the shell can be backed up by a lower fusing alloy or, for short runs. even plaster can be used as a backing. Fusible alloys are most easily used for this method of die production, although with more elaborate metal spraying equipment it is possible to use the higher fusing alloys.

## Factors affecting die design

**Number of Castings Required** — In the situation where a free choice of die type is available, the number of

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**TABLE 1**
**Effect of Die Type on Unit Pattern Costs**

| Cost Factors | Cost Associated with Various Die Types | | | |
|---|---|---|---|---|
| | Cast Dies | | Machined Dies | |
| | 1 Cavity | 4 Cavity | 1 Cavity | 4 Cavity |
| | Die Cost Dollars | | | |
| Labor and Material | 100.00 | 200.00 | 400.00 | 800.00 |
| | Unit Pattern Costs (Dollars) | | | |
| Material | .04 | .04 | .04 | .04 |
| Labor | .05 | .025 | .04 | .02 |
| Die Maintenance* | .02 | .02 | — | — |
| Flash Removal | .02 | .02 | .005 | .005 |
| Total | .13 | .105 | .085 | .065 |

*Includes recasting and repressing due to wear and deformation in use.

castings required often becomes the deciding factor. Table 1 represents a cost breakdown for a hypothetical job. The total cost for producing each pattern, not considering amortization, shows that the least costly die results in the highest pattern cost. These data have been plotted in Figure 1, with the amortization figure included.

Now the unit pattern cost becomes dependent solely on the number of castings required. This, of course, is no different from any other set of production costs which might be calculated against tooling costs. Usually the higher the tool cost and the more elaborate the tooling, the lower the unit production costs. In effect, when 100,000 pieces are required, the die amortization for the most

continued next page

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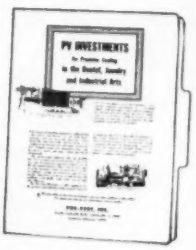


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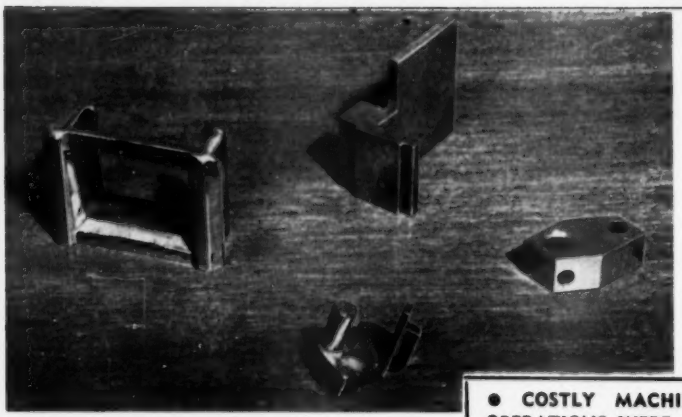
PATTERN DIES — cont.

expensive die is only 0.7 cent more than the cheapest die type. The total unit production costs, however, differ by the sum of 6.5 cents in favor of the more elaborate tooling.

Another factor which might be considered is the production rate demanded of a given job. If maintenance of the production rate requires that several dies be utilized, each die will have to be amortized by the total production of that die. This situation may often favor the application of cast dies. Since most of the die cost of a cast die is concentrated in producing the master pattern, duplicate dies can be produced at little additional cost. In contrast, duplicate machined dies are almost as costly to produce as the original die.

Further consideration of Figure 1 also shows that the typical small order requirement of 200 to 2,000 castings falls prin-



Scale: 2 to 1

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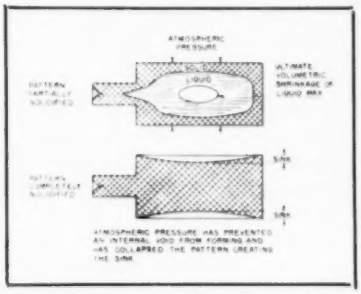
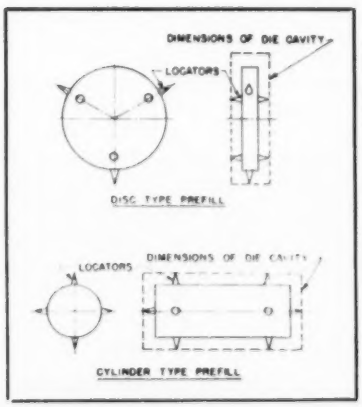
cipally in the range where inexpensive tooling is indicated. It is repeated, however, that this figure represents only one hypothetical situation, and the relative cost will vary greatly with each individual job.

**Dimensional Tolerances** — The production of a casting to specified dimensional tolerances is dependent upon the determination of accurate shrinkage allowance for the die and upon the stability of operating conditions which can cause dimensional scatter. Experience with the process in a given plant will permit an intelligent estimate of the shrinkage allowance for a certain part. This will usually result in a casting conforming with the normal tolerance characteristic of investment castings (± .005 in. per inch). If the initial estimate of shrinkage is close to the center


ATMOSPHERIC PRESSURE
LIQUID
ATMOSPHERIC PRESSURE HAS PREVENTED AN INTERNAL VOID FROM FORMING AND HAS COLLAPSED THE PATTERN CREATING THE SINK

**5. Schematic illustration showing atmospheric pressure causing sinking of pattern surface.**

of the range of natural scatter, the number of rejects will be held to a minimum. Figure 2 is




**6. Prefill designs for preventing sinks in heavy sections.**

a graphic representation of the effect of ideal die dimensioning.

Reproducibility is dependent upon close adherence to a given production process, die type, and design. The reason for close process control is obvious. Die design is a factor because dimensional control in one plane may be easier to effect than in another. For example, dimensions perpendicular to the parting plane are more apt to vary, because the die may not always close completely. This may be due to foreign particles remaining in the parting plane, nicks, or other slight damage occurring to the parting surfaces of the die. Therefore, the component should be oriented in the die so that the dimensions which are to be most closely held do not pass through this plane. Al-

continued next page

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TABLE XIII

COMPARISON OF EFFECTS OF HEAT TREATMENT ON PROPERTIES OF ELECTROLYTIC IRON POWDER PLUS ALLOYS OF VARIED NICKEL—CHROMIUM CONTENTS

Compacting Pressure — 50 tsi
Sintering Condition — 1100 C for 1 hour at temperature in hydrogen

MATERIAL

Electrolytic Iron + 1% Graphite + 10% Alloy (80% Ni — 20% Cr)

| | TENSILE STRENGTH PSI | ELONGATION %IN 1" | ROCKWELL HARDNESS | SINTERED DENSITY G CC |
|---|---|---|---|---|
| Sintered | 72200 | 2.5 | Rb83 | 7.11 |
| Coined | 76300 | 4.0 | Rb85 | 7.11 |
| Coined & Annealed | 71000 | 3.5 | Rb84 | 7.11 |
| Coined & Quenched | 99500 | 1.7 | Rc25 | 7.15 |
| Coined, Quenched & Annealed | 75800 | 3.5 | Rc15 | 7.08 |
| Quenched | 88650 | 2.1 | Rc19 | 7.11 |
| Quenched & Annealed | | 2.1 | Rc16 | 7.11 |

Size Characteristics (80% Ni — 20% Cr)

| | |
|---|---|
| 100 | 2.4% |
| 100 - 200 | 11.9% |
| 200 - 325 | 28.5% |
| 325 | 17.2% |

Electrolytic Iron + 1% Graphite + 10% Alloy (80% Cr — 20% Ni)

| | TENSILE STRENGTH PSI | ELONGATION %IN 1" | ROCKWELL HARDNESS | SINTERED DENSITY G CC |
|---|---|---|---|---|
| | 66100 | 2.0 | Rb99 | 6.64 |
| | 83000 | 2.0 | Rb95 | 6.65 |
| | 84300 | 2.0 | Rb95 | 6.65 |
| | 92900 | 2.0 | Rb100 | 6.65 |
| | 84000 | 2.0 | Rb96 | 6.65 |
| | 72300 | 2.0 | Rb97 | 6.65 |
| | | 2.0 | Rb95 | 6.65 |

Size Characteristics (80% Cr — 20% Ni)

| | |
|---|---|
| 100 - 200 | 4.7 |
| 200 - 325 | 9.7 |
| 325 | 85.6 |

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though this is not always possible, it should be considered.

The effect of selection of die type is also obvious. The machined steel dies are more stable dimensionally than the cast fusible alloy dies. Therefore, the tolerance requirement of a specific job may dictate the use of a machined steel die, even when the quantity involved is only moderate.

**Types of Injection Machines Available** — The pattern die should be designed for maximum effectiveness with the available injection equipment. Certain types of injection apparatus are relatively insensitive to the type of venting provided in the die. Others require careful development of the parting line, location of the sprue, and maximum venting to eliminate pockets of entrapped air. These factors will be discussed in greater detail under another heading.

**Size and Shape of Part** — The selection of die type is often dependent upon the shape of the casting concerned. The economics of cast die vs machined die is often related to the costs of producing a master pattern, plus casting the die vs the cost of machining a steel or brass die. Ordinarily, it is much more costly to machine out a negative of a given part (corresponds to the machined die) than to produce a positive (master pattern). Many components, however, can be produced economically in negative. For example, a part which resembles a simple cylinder can easily be made by boring out a tube and inserting a core which may be fixed to either or both ends. Many parts found in practice approximate this shape with modifications. The advantage of machining such a die lies in producing a more permanent die at little extra cost.

Since a machined die generally weighs less than a cast die, it is often advantageous

to use the former construction for exceptionally large parts. The cast die may be so heavy as to become unwieldy for the wax injection operation. This consideration is even more pertinent if female help is employed for wax pattern production.

## Fundamental considerations of die design

**Filling the Die** — The problem of getting the pattern material to completely fill the die can be often solved by good die design. The injection equipment used is also a factor. The die designer must take into consideration the injection pressures involved to be sure that the mechanical strength of the die is sufficient. The mode of entry of the wax into the die must also be considered.

One of the factors which prevents complete filling of the die is entrapped air. This occurs because of inadequate venting of the die cavity. Inadequate venting may be due to the presence of blind pockets or insufficient vent area so that the air in the die cannot be purged as rapidly as the wax enters the cavity. The vent area is represented by the space remaining between the die parts when the die is closed, plus the cross-sectional area of any additional vents incorporated into the die.

The venting of each die is an individual problem. The location of the sprue should be so determined that a minimum of blind pockets exists. It is usually good practice to place the sprue in the parting plane when two part dies are used Figure 3 shows the advantage of such design. The mold shown on the left has a large potential blind pocket, while the mold on the right permits exit of the air, until the very last part of the cavity is being filled.

When soft metal dies that do not have a protective hard shell are used it is necessary to provide additional vents to permit the air in the mold to escape. The die clamping pressure is usually great enough so that the two halves of the die tend to flow together and in time develop a very intimate mating of the parting surfaces. This impairs the natural venting of the mold, and artificial vents must be provided so that the air can be purged from the mold. These vents are usu-

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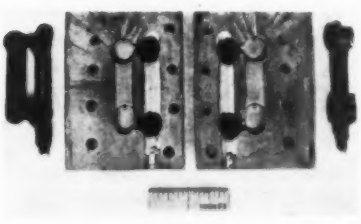
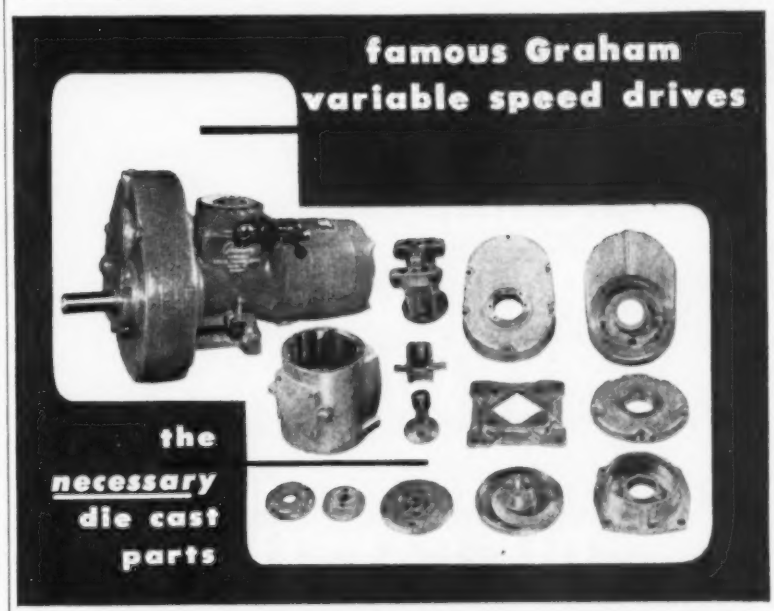


**7. Fusible alloy die showing application of blind risers with insulating rubber pads to reduce sinks in heavy section of pattern.**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ally narrow slits which run from the edge of the mold cavity to the outer end of the mold. Usually, the slits are cut by hand and at the point where they join the mold cavity they become extremely small in cross-section. During the injection cycle the air is readily forced through these slits. When the wax enters the slit the small area of the vent causes the wax to rapidly solidify and seal the slit before the wax can run out through the end of the mold.

Very often blind pockets are present which cannot be avoided by judicious arrangement of the sprue. Figure 4 illustrates this type of difficulty and shows one method of correction. Increased pressure alone cannot eliminate an unfilled area. The air trapped in the die can be reduced in volume by higher injection pressures, but obviously never eliminated. Elimination of these defects can only be attained if either an exit is provided for the trapped air or a pocket is cut into the die to contain this entrapped gas. The defect is thus transferred into the drilled hole cut into the appropriate location. The small protrusion which results on the pattern is cut away easily with a sharp blade. Another method, which is sometimes applied in such a situation, is to drill a fine hole through to the outside surface of the mold. The air in the cavity is expelled readily through the hole. However, as soon as the wax enters the vent hole, it begins to solidify thereby sealing off the cavity.

Venting difficulties are encountered most frequently in soft metal dies. Machined steel dies are usually assembled with many individual pieces and the fit between the components is usually free enough to provide a considerable vent area. This does not suggest that machined dies are produced to broad tolerances, but that the larger number of mating surfaces provide a better distribution as well as greater area for venting. Figure 9 shows a die of this type. Another basic difference between the machined die and cast die is that the machined die will maintain its natural venting characteristics.

Air entrapped within the pattern can sometimes cause defects in the investment casting. This difficulty can usually be traced to high rates of wax injection into the die. If the en-

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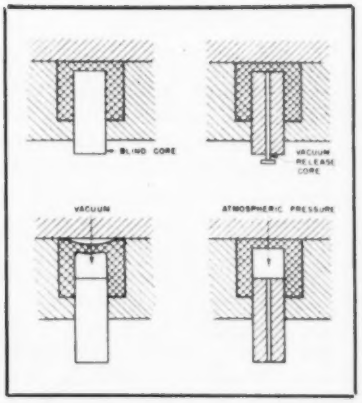


**8. Function of a vacuum release core in preventing collapse of wax under atmospheric pressure.**

trained volume of air is relatively large, and if it is close to the surface of the pattern, it will not survive the investing operation, if a vacuum technique is used. This air is contained in the pattern at a pressure approximately equal to the absolute injection pressure. This is balanced in some measure by the atmospheric pressure around the pattern. If this atmospheric pressure is removed, as is the case during the vacuuming operation, the effective pressure within the wax pattern may become sufficiently large to burst the thin shell between the air and the outer surface of the pattern. This will cause the investment to fill the space originally occupied by the entrained air and will thus produce a defective mold.

When all the air in the die cavity has been replaced with wax, the next problem is to have the pattern retain the shape of the cavity after it has cooled. The low rate of heat transfer through the wax develops steep thermal gradients near the die walls. Where the small patterns are concerned these thermal gradients do not cause any difficulty. However, the larger the volume of wax involved the greater will be the temperature variation between the wax in contact with the die cavity and the wax in the center of the

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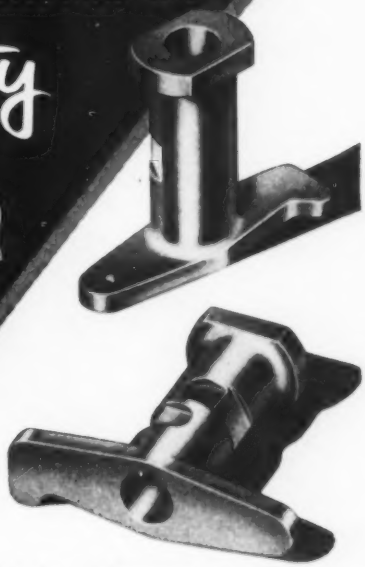

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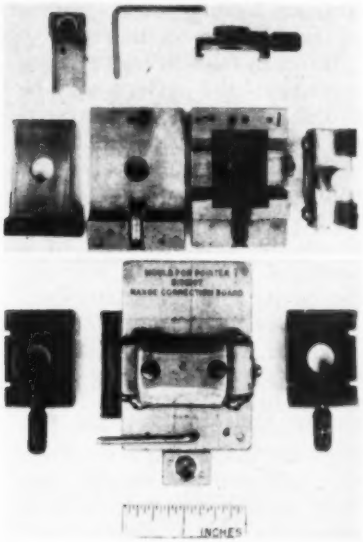
pattern. Since waxes have relatively high thermal shrinkage, it is necessary that adequate feeding be maintained at least until a shell which is sufficiently thick to resist deformation has formed. The volumetric shrinkage of the wax will if improperly fed create a void. If this void is not connected to the atmosphere by means of a pipe or channel, the pressure within the void will be practically nil. The atmospheric pressure acting against the outer surfaces of the pattern will tend to deform the wax to close the void. This phenomenon is illustrated schematically in Figure 5.

Die design is an important factor in correcting sinks. The most effective corrective measure is to develop directional solidification of the wax pattern and thus promote feeding during the solidification period. Other aids to the solution of this problem are use of minimum wax injection temperatures, maximum pressures and the use of prefills. Prefills are used to reduce the volume of molten wax necessary to fill a comparatively heavy section. Successful use of prefills is dependent on striking the proper balance between the volume of the prefill and the total volume of the section involved. The prefill is made separately and provision must be made for locating it inside the die cavity. This is done by incorporating thin members running from the main body of the prefill to the edge of the die cavity. Figure 6 illustrates two typical designs. The locating members should be as thin as possible to avoid the creation of surface defects on the finished pattern. The hot wax should fuse itself to the thin locating sections of the prefill and form a continuous surface on the pattern.

Another method which may be used to promote feeding of the pattern is to incorporate into the die a cavity which would be analogous to the

blind riser in a sand casting. Figure 7 shows a die which utilizes this device to feed the heavy sectons. In order to increase the efficiency of the



**9. Disassembled machined die, above, shows pattern ready for removal. Below is shown the assembled die with patterns.**

continued next page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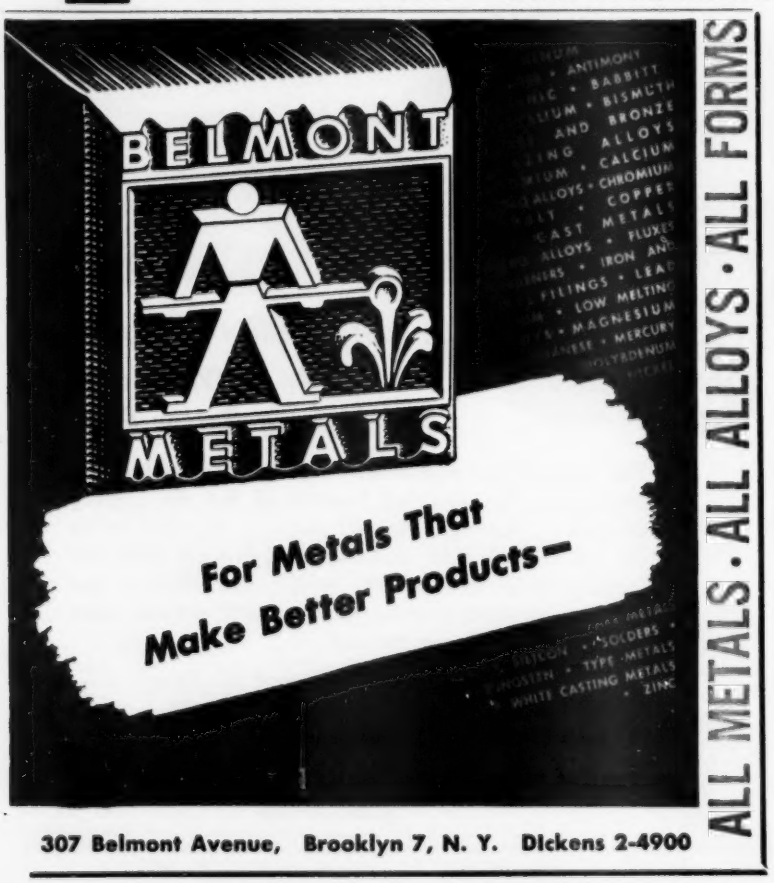
PATTERN DIES — cont.

cavity, sheet rubber inserts are placed at the ends of the cavity. The low thermal conductivity of the rubber tends to favor feeding the die cavity at the expense of the riser.

Sinks in the surface of heavy sections of the pattern may be avoided sometimes by arranging the sprue location and size so that a pipe will develop and connect the shrinkage cavity to the atmosphere. This prevents the establishment of a pressure differential between the cavity and the atmosphere which is the cause for the sinks. If a vacuum treatment is used for the investing cycle, it is desirable to fill the cavity which remains with a low fusing wax. If vacuum is not used, no additional processing other than sealing the hole will be necessary.

Feeding of heavy sections can be promoted by the application of air pressure to the sprue while the pattern still

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remains in the die. The conditions outlined in the previous paragraph must be satisfied in order for the air pressure to be effective. This process is termed "blowing the pattern" and the air pressure generally used is 100 psi.

**Core Removal** — The removal of cores from the pattern is best accomplished while the pattern is still in the die. It is therefore good practice to design cores which may be removed before the die is parted. Considerable pull is required to remove large cores and the die cavity provides the very best support for the pattern during this operation.

When blind cores are used, a special problem is developed in their removal. The force necessary to withdraw a given core is equal to the friction between the core and the pattern, plus the atmospheric pressure acting on the cross-section of the core. Figure 8 shows how atmospheric pressure acts to deform the pattern and also the method of overcoming this difficulty.

If a large draft is provided on the core, the vacuum within the core cavity may be released before the pattern has been permanently deformed. Very often only moderate draft can be tolerated, and it is necessary to incorporate a vacuum release feature in the core. This subtracts the atmospheric pressure acting on the cross-section of the core from the total pull necessary to remove the core.

Patterns which have their cores withdrawn after removal from the die should be provided with strippers to avoid deformation of the patterns. These may be made from brass, wood, masonite, or other suitable material. The stripper is designed to give adequate clearance to the core and to contact the pattern surface over a maximum area.

**Pattern Removal** — The third fundamental factor affecting die design is the removal of the pattern. Unlike plastic moldings or metal die castings, wax patterns possess low mechanical strength. The methods generally used to strip metal and plastic moldings from their dies would destroy the wax pattern. Full advantage must be taken of parting line location, draft, if permitted, and the natural shrinkage of the wax in order to facilitate removal of the pattern from the die.

The proper sequence of disassembly operations will often ease the removal of a pattern. It is desirable to use removable cores in the die and withdraw the cores as soon as possible after injection. The shrinking wax tends to seize the cores and interferes with removal of the pattern. Machined steel and brass dies are particularly

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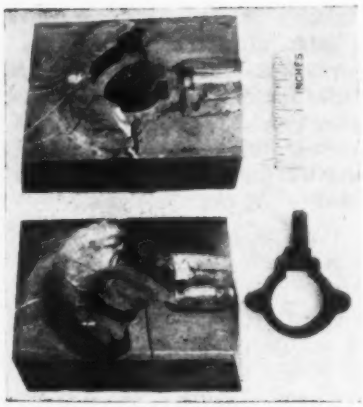
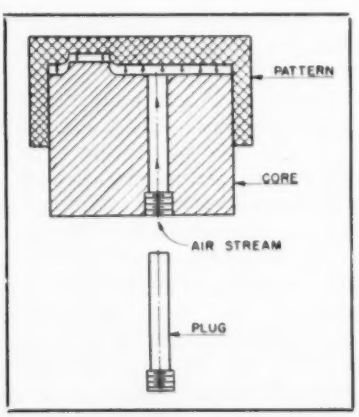
well suited for easy withdrawal of the pattern. All the cores are pulled and the die then disassembled in a manner that leaves the pattern free to be lifted from the die. Figure 9 shows such a disassembled die with the pattern ready for removal. A view of the assembled die is also included.

It is sometimes desirable to employ cores which are integral with the die. In order to avoid seizure by the wax, it is good practice to pass a parting plane diagonally through the core. Figure 10 shows a die which was designed for this effect. In separating the halves of this die, half the surface area of the core contacting the pattern is removed with the die half. This greatly simplifies stripping the pattern from the die half which holds it.



**10.** Die showing diagonal parting of an integral core. Parting line arranged to equalize die surface area.

Air pressure is frequently very useful in stripping the pattern from the die. If the air stream is directed against the pattern which is embedded in the die half, sufficient pressure can generally be generated between the pattern and die surfaces to dislodge the pattern. If greater force is necessary, an air stripper may be designed into the die. Figure 11 shows how this may be done. The plug of the stripper hole is removed and the air stream directed into the hole against the pattern. Since the pressure is equally distributed over the surface area of the pattern, considerable force can be de-




**11.** Design method and function of an air core stripper.

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veloped without applying an excessive localized pressure.

Mechanical stripping of the pattern is possible if the component design is favorable. This requires that ejection pressure be applied centrally so that the pattern is not cocked by the ejector, and that sufficient area be available so that the unit pressures required do not deform the pattern.

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**Editor's Note: Part Two of this paper will be presented in the April issue of PMM. It will continue discussion of such matters as shrinkage allowances, casting, pressing, centrifuging and machined dies.**

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### ALUMINUM GROUP ELECTS OFFICERS FOR 1953

At the annual meeting of The Aluminum Association held January 20-22 in New York, D. A. Rhoades, Kaiser Aluminum & Chemical Corporation, Oakland, California, was elected president for the ensuing year. Three vice- presidents and three directors-at-large also were elected. A. V. Davis, Aluminum Company of America, New York, was re-elected chairman of the board and Donald M. White was reappointed secretary and treasurer.

Elected to serve as vice-presidents of The Association for the ensuing year were: S. D. Den Fyl, Bohn Aluminum & Brass Corporation, Detroit Michigan; Raymond Deutsch, Monarch Aluminum Manufacturing Company, Cleveland, Ohio and R. P. Stranahan, Stranahan Foil Company, Inc., South Hackensack, New Jersey. Elected as directors-at-large for three year terms were: R. A. Blanchard, Detroit Gasket & Manufacturing Company, Detroit, Michigan; A. P. Cochran, Cochran Foil Compan, Louisville, Kentucky, the outgoing president of the Association; and R. G. Tessendorf, Aluminum Industries, Inc., Cincinnati, Ohio.

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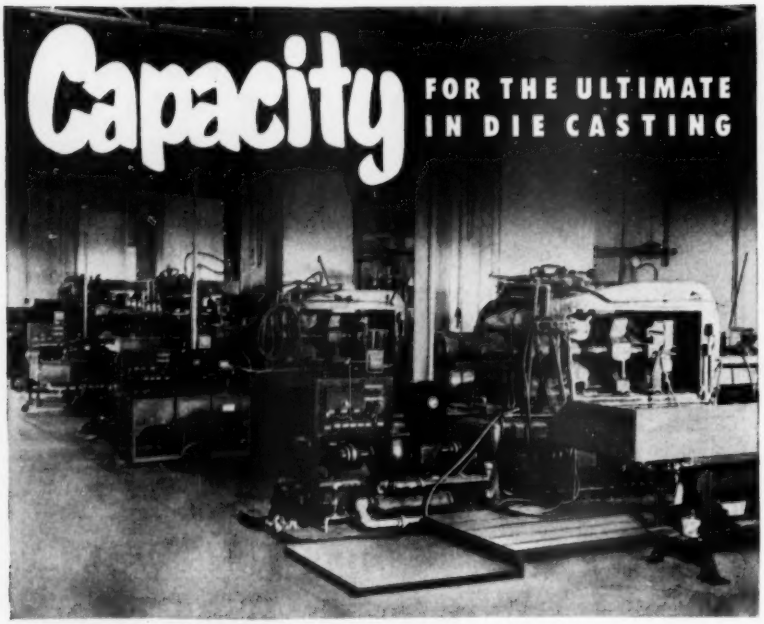

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A section of high-pressure aluminum casting machines (cold chamber) illustrates one of the many modern production methods that is part of our complete die casting services.

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## NEW COMPANY TO MAKE ALUMINUM-SILICON METAL

A new organization, the National Metallurgical Corporation, was recently formed by Apex Smelting Company of Chicago, and The American Smelting & Refining Company with offices in New York.

The new firm will build and operate a pilot plant at Springfield, Ore., to produce aluminum-silicon metal from clay. The new plant is expected to be in operation by mid-1953.

Officers named are: William A. Singer, president; R. D. Taylor, vice president; R. K. Beck, vice president; L. Lippa, secretary-treasurer.

Directors, in addition to officers, are: Edgar L. Newhouse, Jr., Leo Halpern, James B. Wescott, Gordon W. Reed, Robert D. Bradford, and Oscar S. Strauss.

---

**METAL DATA, 2nd Edition; Samuel L. Hoyt; published by Reinhold Publishing Co., 526 pages, $10.00**

In the preface to the second edition of his book, Hoyt says that this book is an outgrowth of his personal desire to have data on metals and alloys that is brief, but adequately comprehensive for engineering use and, above all else, reliable.

That he has succeeded is attested by even a cursory examination of the present volume. Almost all metals and alloys of any importance are covered and the data both as to composition and properties are the most accurate that is presently available.

Following a short chapter or two that give necessary background information on test specimens, testing, hardness, etc. the book enters into the properties of metals and alloys in an orderly and logical manner. All verbiage has been reduced to a minimum so that at times the presentation of the data may seem a little bald.

Metal Data is a valuable addition to the working library of every metallurgist and engineer.

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# ADVERTISERS' INDEX

**MARCH, 1953**


**A**

A.B.C. Die Casting Machine Co. ..... 94
Accurate Die Casting Co. ..... 84
Acheson-Colloids Co. ..... 5
Acme Aluminum Alloys, Inc. ..... 10
Adapti Company ..... 70
Advance Tool & Die Casting Co. ..... 89
Ajax Engineering Co. ..... 14
Aldrich Pump Co. ..... 9
Allied Research Products, Inc. ..... 59
Almco Div., Queen Stove Works, Inc. .. 61
American Chemical Paint Co. ..... 66
American Smelting & Refining Co. ..... 41
American Zinc Sales Co. ..... 18
Apex Smelting Co. ..... Cover 4
Armour & Co. ..... 58
Atlantic Casting & Engineering Corp. .. 6

**B**

Badger Die Casting Corp. ..... 73
R. N. Bailey & Co. ..... 81
Belmont Smelting & Refining Works, Inc. 94
Beryllium Corp. ..... 8

**C**

Cannon-Muskegon Co. ..... 76
Carborundum Co. ..... 52
Cast-Master, Inc. ..... 1
Casting Engineers, Inc. ..... 45
Central Die Casting & Mfg. Co., Inc. ... 86
Central Screw Co. ..... 63
Cleveland Automatic Machine Co. ..... 17
Cleveland Hardware & Forging Co. ..... 87
Crucible Steel Co. ..... 16

**D**

DeCardy Bros. Co. ..... 94
Dollin Corp. ..... 13

**E**

Eaton Manufacturing Co., Reliance Div. . 69
Ekstrand & Tholand Inc. ..... 96
Electronicast, Inc. ..... 81

**F**

Federal Die Casting Co. ..... 74
Federated Metals Div., American Smelting & Refining Co. ..... 92

**G**

Grav-i-Flo Corporation ..... 65
Gries Reproducer Corp. ..... 72
Groov-Pin Corp. ..... 57

**H**

Hampden Brass & Aluminum Co. ..... 93
Harper Electric Furnace Co. ..... 74


continued next page


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## AD INDEX

continued from page 99


Henning Bros. & Smith, Inc. ..... 80
Hitchiner Mfg. Co., Inc. ..... 91
M. Holtzman Metal Co. ..... 78
Hoover Co. ..... 11
Howard Foundry Co., Investment Casting Div. ..... Cover 3
Hydraulic Press Manufacturing Co. ..... 22

**I**

International Nickel Co., The ..... 12

**K**

Kiowa Corp. ..... 19
Kuhlman Die Casting Co. ..... 75
Kux Machine Co. ..... 47

**L**

Lester-Phoenix, Inc. ..... 24
Lindberg Engineering Co. ..... 27
Litemetal Dicast, Inc. ..... 70

**M**

Madison-Kipp Corp. ..... 25
Malone Metal Powders ..... 93
Metal Hydrides, Inc. ..... 88
Milwaukee Die Casting Co. ..... 93
A. Milne & Co. ..... 40
Monarch Aluminum Mfg. Co. ..... 48
Mt. Vernon Die Casting Corp. ..... 28

**N**

New England Die Casting Co. ..... 80
Newton-New Haven Co. ..... 4
Nobur Mfg. Co. ..... 68

**O**

Oakite Products, Inc. ..... 69

**P**

Pangborn Corp. ..... 61
Paragon Die Casting Co. ..... 90
Paramount Die Casting Co. ..... 71
Parker White-Metal Co. ..... 23
Peerless Gear & Machinery Co., Inc. ..... 85
Plastics Metals Div., National Radiator Co. ..... 76
Precise Products Co. ..... 68
Precision Castings Co., Inc. ..... Cover 2
Pressco Casting & Mfg. Co. ..... 15
Pressure Castings, Inc. ..... 7
Pre-Vest, Inc. ..... 85

**R**

Racine Die Casting Co. ..... 76
Roto-Finish Co. ..... 54
Rupert Diecasting Co. ..... 30

**S**

St. Joseph Lead Co. ..... 26
Severance Tool Industries, Inc. ..... 86
Sonken-Galamba Corp. ..... 98
Standard Machinery Co. ..... 85
Stewart Warner Corp. ..... 21
Stroh Die Moulded Castings Co. ..... 100
Stroman Furnace & Engineering Co. ..... 20
Superior Die Casting Co. ..... 99

**T**

Thompson Products, Inc., Light Metals Div. ..... 37
Twin City Die Casting Co. ..... 97

**U**

U. S. Reduction Co. ..... 29
Universal Die Casting Co. ..... 95

**V**

Vanadium Alloys Steel Co. ..... 3

**Z**

Z & H Mfg Co. ..... 86

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